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University of Alberta

MULTIVARIATE MAPPING OF ETHNIC DIVERSITY IN EDMONTON

By

Lori Schlereth-Husak

A Thesis

Submitted to the Faculty of Graduate Studies and Research

in partial fulfilment of the requirements

for the degree of

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DEPARTMENT OF GEOGRAPHY

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Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for the acceptance, a thesis entitled **Multivariate Mapping of Ethnic Diversity in Edmonton** by **Lori Anne Schlereth-Husak** in partial fulfillment of the requirements for the degree of **Master of Science.**

Dedicated to my son Jason Michael

my inspiration for finishing

and to my Husband and Family

for all their support and encouragement

Abstract

Conventional mapping of Canada's ethnic diversity has consisted of mapping single variables (eg. ethnic origin) and single groups (eg. Chinese) one at a time. In an attempt to add to the understanding of ethnic diversity and ethnic group cohesion, the focus of this thesis is on the production of multivariate maps that clearly portray the complex distribution of the multicultural components the define "ethnicity". Through the development of a hybrid methodology that combines the use of multivariate statistics (cluster analysis) and a Geographic Information System (GIS), the distribution of ethnic diversity and ethnic group cohesion in Edmonton is mapped and analyzed. The results of this research not only adds to the understanding of ethnic diversity and cultural cohesion in Edmonton, but also the statistical and cartographic techniques developed provide a useful new methodology for the compilation, analysis, and dissemination of census data in general.

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Table of Contents

Chapter 1 Introduction 1

Background 2
Objectives 4

Chapter 2 Data 5

Census Data 5
Spatial Data 7

Chapter 3 Multivariate Mapping 9

Cluster Analysis 9
GIS Methodology 14
Final Map Design 20

Chapter 4 Analysis 22

Major Ethnic Groups, Mother Tongues, and Home Languages 22
Single Category Maps 27
Two-Category Maps 36
Comprehensive Map 43

Chapter 5 Conclusions and Future Research 46

Specific Conclusions 46
Methodological Conclusions 47
Future Research 48

References 49

Appendix 1 53

Appendix 2 57

Appendix 3 67

Appendix 4 71

List of Figures

		Page
Figure 1.	Cluster numbers versus F-ratio graph for ethnic origin. Peaks indicates optimal clustering.	11
Figure 2.	Cluster numbers versus F-ratio graph for mother tongue (excluding English).	12
Figure 3.	Cluster numbers versus F-ratio graph for home language (excluding English).	13
Figure 4.	Leading single ethnic origins in Edmonton in 1991.	23
Figure 5.	Leading single non-English mother tongues in Edmonton in 1991.	25
Figure 6.	Leading single non-English home languages in Edmonton in 1991.	26
Figure 7.	Ethnic origins (above threshold values) versus city average for cluster 12.	29
Figure 8.	Ethnic origins (above threshold values) versus city average for cluster 11.	30
Figure 9.	Ethnic origins (above threshold values) versus city average for cluster 2.	31
Figure 10.	Non-English mother tongues (above threshold values) versus city average for cluster 12.	33
Figure 11.	Non-English mother tongues (above threshold values) versus city average for cluster 2.	34

Page

Figure 12. Non-English mother tongues (above threshold values) versus city average for cluster 11. 35

Figure 13. Non-English home languages (above threshold values) versus city average for cluster 12. 37

Figure 14. Non-English home languages (above threshold values) versus city average for cluster 4. 38

List of Maps

Map 1. Culturally Cohesive Ethnic Groups in Edmonton (One Per cent Threshold)

Map 2. Predominant Ethnic Origins in Edmonton

Map 3. Predominant Mother Tongues in Edmonton

Map 4. Predominant Home Languages in Edmonton

Map 5. Culturally Cohesive Ethnic Origins and Mother Tongues in Edmonton

Map 6. Culturally Cohesive Ethnic Origins and Home Languages in Edmonton

Map 7. Culturally Cohesive Languages in Edmonton

Map 8. Culturally Cohesive Ethnic Groups in Edmonton

CHAPTER 1
INTRODUCTION

At the turn of the century, Canada was a country comprised mainly of two major ethnic groups -- British and French. Peoples of other ethnic backgrounds made up a relatively small proportion of the total population. By 1986, Canada had become a truly multicultural country, consisting of over 100 distinct ethnic and cultural communities (White 1990). The peoples of Canada have become immensely more diverse, not only in terms of a greater variety of groups, but also in terms of increased membership within each group (Herberg 1989).

As the peoples of Canada have become increasingly more diverse, analysis and understanding of this ethnic diversity has also become more complex. Analysis and mapping of Canada's ethnicity has been a limited undertaking due to the well-known limitations of census data (Bourne *et al*. 1986). As indicated by Herberg (1989) "a work with analysis of more than two ethnicities is, however, exceedingly rare, especially one focusing on patterns of differentiation between multiple ethnic communities." For example, any understanding of ethnicity has to be obtained from about two hundred ethnocultural variables contained in the Census of Canada. Variables describing ethnic origins, mother tongues, home languages, places of birth, religions, and citizenship etc. are all variables related to the concept of ethnicity.

Conventional mapping of Canada's ethnic diversity has consisted of mapping single variables (eg. ethnic origin) and single groups (eg. Chinese) one at a time. In an attempt to add to the understanding of ethnic diversity, the focus of this thesis is on the production of multivariate maps that clearly portray the complex distribution of the multicultural components that define "ethnicity". Through the use of multivariate statistics (cluster analysis) and the use of a

Geographic Information System (GIS), the distribution of ethnic diversity and ethnic group cohesion in Edmonton is mapped and analyzed.

Background

The prairie provinces exhibit a high level of ethnic diversity, largely due to the large scale immigration that took place at the turn of the century during the agricultural settlement of the west. Edmonton is typical of most western Canadian cities with high indices of diversity. Bourne *et al.* (1986) calculated a diversity index (an ethnic diversity index of 0 represents a completely homogenous population, while an index of 1 equals total heterogeneity) of 0.85 for Edmonton based on 1981 ethnic origins; Edmonton therefore is an ideal test case for this research. Although ethnic diversity can be measured as an index and mapped, ethnic diversity is not a fully understood concept because the measurement is based solely on a single variable.

The comprehension of the concept of ethnic diversity requires an understanding of the term ethnicity and related terms that describe the multicultural components of ethnicity. Herberg (1989) suggests that ethnicity is a major organizing principle in Canadian life and he uses the term ethnicity "to include people who have been counted and/or who have counted themselves, as belonging to a particular group, usually by birth and by practices and perceptions." Herberg (1989) also proposes that cultural survival is contingent on four ethnic cohesion mechanisms. These mechanisms include; retention of language, residential concentration, maintenance of the ethnicity's religion, and maintenance of cultural institutions (Herberg 1989). Because few empirical studies of ethnic group cultural retention have examined more than one ethnic cohesion mechanism (Herberg 1989), two of the four ethnic cohesion mechanisms -- language retention and residential concentration

are explored in this thesis.

Sapir (1933) indicated that language functions as an influential social force that ties an ethnic group together and Wardhaugh (1983) stated that "the principal mainstay of minority culture in Canada is language". Herberg (1989) claims that in almost all ethnicities found in Canada, "language is part and parcel of group ethnoculture". Language retention as an index of the extent to which the ethnic or heritage language (mother tongue) is still understood and used in speech has been put forward by Herberg (1989) as perhaps the single most important indicator of both collective identity definition and of ethnocultural cohesion. Those who are concerned about their cultural heritage, usually are also concerned about their ancestral language (Royal Commission 1970).

Because the census definition of mother tongue does not necessarily imply use, Herberg (1989) suggests that home language "touches closer to *home*" in the preservation of an ethnic group's culture and is probably a better indicator of the magnitude of linguistic survival and use of the language than mother tongue.

Residential concentration, as suggested by Herberg (1989), is another significant factor in ethnic group cohesion. The size of the membership in a city's ethnic community heightens the likelihood of social interactions among people in the ethnicity, thus leading not only to higher language retention, but also the possibility of carving out an ethnic residential territory within the city (Herberg 1989). "The existence of high residential concentration, especially within cities, enabled the concentration of ethnic group members necessary for the continuing of the daily use of the ethnic language" (Herberg 1989).

Objectives

The overall objective of this thesis was the development of a hybrid methodology that combines the use of multivariate statistics and GIS technology in mapping Edmonton's ethnic diversity and cultural cohesion. The resulting exploratory multivariate maps and a final comprehensive map graphically contributes to the understanding of the distribution of ethnic diversity and ethnic group cohesion in Edmonton.

CHAPTER 2
DATA

The study area for this research is comprised of the census tracts within the boundary of the city of Edmonton and the principal data source was the 1991 Census of Canada obtained in digital format. Because a geographic information system (GIS) is a well established tool for combining and analyzing many types of geo-referenced data (Aronoff 1989), *Arc/Info* was used for the storage, analysis and display of the 1991 Census data for the city of Edmonton. The strength of a GIS lies in its ability to analyze spatial and attribute data simultaneously (Aronoff 1989; Tomlinson 1989). The non-spatial attribute data consisting of the ethnocultural variables and the spatial basemap data (file containing geographic coordinates defining the census tract boundaries) were incorporated in the GIS.

Census Data

Despite limitations, the 1991 Census data still represent the most comprehensive set of information available that define Edmonton's ethnic diversity. This information, in the form of maps and tables are based on proportional data from the 1991 Census of Canada as reported for 142 census tracts comprising the city of Edmonton. As defined by Statistics Canada, the population of a census tract must be between 2500 and 8000 with a preferred average of 4000 persons, and the census tracts must be as homogenous as possible in terms of economic status and social living conditions. Larger or smaller populations may exist in peripheral urban or rural areas, as well as in major commercial or industrial districts.

Census variables used in this study consist of single response data for ethnic origin, mother tongue and home language. Census tracts that are of different sizes and

containing raw counts makes comparison impossible. Therefore all data were extracted as proportions expressed as per cent single response for ethnic origin and per cent non-official language for mother tongue and home language.

Mother tongue data was extracted from the census *Profile A* which is based on data collected by the 1991 Census of Canada from all households (100 per cent sample). Data for home language and ethnic origin (as percentages) were obtained from the census *Profile Part B*, based on data collected by the 1991 Census of Canada from one of every five households (20 per cent sample). Because the multiple response data did not list individual languages, thereby eliminating comparability amongst data sets, it was not considered. The single response data used for mother tongue and home language, includes 97 per cent of all respondents (3 per cent consisted of multiple responses that were excluded). Whereas, with ethnic origin, only 60 per cent of all respondents stated a single origin (40 per cent excluded because of a multiple response).

Ethnic origin refers to the ethnic or cultural group the respondents' ancestors belonged to on arrival to this continent. British origins include English (66 per cent), Scottish (19 per cent), Irish (14 per cent) and other British (1 per cent). For a listing of the twenty-nine single ethnic origins used in this study see Table 1.1 in Appendix 1.

Mother tongue refers to the first language learned at home at childhood and is still understood by the individual at the time of the census. Individuals of Indian and Amerindian (North American Indian) descent were asked to report a single language (ie Hindi or Chipewyan etc.). Because the focus of this thesis is on ethnic diversity, people who reported English as a single response mother tongue (80 per cent for Edmonton CMA) were excluded. For a listing of the twenty-seven mother tongues used in this study see Table 1.2 in Appendix 1.

Home language in the 1991 Census refers to the language usually employed as the medium of communication in the home. Parallel to mother tongue, those who reported English as their single response home language (91 per cent) were also not included in these data. For a listing of the thirty-two home languages used in this study see Table 1.3 in Appendix 1.

Spatial Data

Along with the ethnocultural attribute data, the corresponding spatial data (in *Arc/Info export* format) consisting of geographic coordinates that define the census tract boundaries, were also incorporated into the GIS. Because the spatial data obtained from the Census of Canada did not provide geographic coordinates for just the city of Edmonton, the spatial data for the entire Edmonton Census Metropolitan area (CMA) was utilized.

Although the digital data provided by Census Canada were structured in a format specific to the Arc/Info system, certain data verification procedures were required because several topological inconsistencies soon became apparent. For example, topological problems such as lines that did not meet precisely (ie. overshoots and undershoots), as well as missing lines that created unclosed polygons (census tracts) were found. Before this spatial data could be used properly in Arc/Info the file had to be run through both an automated and manual *cleaning* process to rectify these problems.

In addition to the graphic inconsistencies in the spatial data, the corresponding attributes (coded by geographic location) also had to be checked for accuracy before any ethnocultural variables could be correctly linked to the data base. Because a GIS requires attributes (census tract labels by geographic location) to be logically attached to the features they describe (census tract polygons), inconsistencies had to be corrected. Each census tract was

examined to ensure the polygons were accurately labelled and the spatial data cleaned, the ethnocultural attribute data could then be linked by geographic location. Once the census data base was compiled, including the elimination of data processing errors, the mapping process and analysis could begin.

CHAPTER 3

MULTIVARIATE MAPPING

Single variable mapping is a well established methodology that has been extensively used for the display and analysis of spatial data. Techniques for creating two-variable maps are less common and were first used by the United States Census Bureau in their Urban Atlas series published in the mid-1970s (U.S Bureau of the Census 1975). A considerable amount of cartographic research has focused on the production and evaluation of bivariate maps (Carstensen 1982, 1986; Dunn 1989; Eyton 1984; Lavin and Archer 1984; Olsen 1972, 1981; Trumbo 1981). Little cartographic research however has addressed the utility and problems associated with multivariate mapping. In addition to univariate and bivariate mapping, multivariate mapping can be a powerful methodology for the analysis and display of spatially distributed multicomponent data.

Cluster Analysis

Before producing maps, the development of a broader and statistically based multivariate definition of ethnicity was required. The procedure used to achieve this objective was K-means cluster analysis (Späth 1980; Aldenderfer and Blashfield 1984). Cluster analysis is a multivariate grouping procedure that divides a population into natural categories or groups so that the groups are as internally homogenous as possible, but distinctly separate as possible from other groups. Cluster analysis is an aspatial multivariate technique relying only on the relationships between the variables to create homogenous groupings. When the clustered observations are mapped, spatial context (if it exists), should become apparent in the displayed distribution.

Three runs of cluster analysis were performed on the

three different standardized data sets (ethnic origin, mother tongue, and home language) and the statistic for groupings (K) of K = 5 to K = 35 determined. Each run produced a "cluster numbers versus F-ratio graph" that was used to determine the optimal number of clusters. The F-ratio which is calculated from the division of the between group estimate of variance and the within group estimate of variance will be large in value when an optimal clustering maximizes the between group variance and minimizes the within group variance. Optimal groupings can be found through inspection of the F-ratio versus cluster number graph (Figures 1, 2, and 3).

Cluster analysis produces no single optimal number of clusters. Because more than one optimal number of clusters is possible, two subsequent cluster runs were executed on each dataset using the local minimums and local maximums of the F-ratio as the initial exploratory optimal number of clusters. For example, in the analysis of the ethnic origin data set, the local minimum of eleven clusters and the local maximum of thirty-two clusters were selected and mapped (see Figures 2.1 and 2.2 in Appendix 2). In the analysis of mother tongue, six clusters and thirty-two clusters were selected and mapped (see Figures 2.3 and 2.4 in Appendix 2). In the analysis of the home language data set, the local minimum of nine clusters and the local maximum of thirty-three clusters were selected and mapped (see Figures 2.5 and 2.6 in Appendix 2).

Once these clustered observations were mapped, and spatial context was realized in the mapped distributions, the choice of the high number of clusters showed too much fragmentation and was too detailed for this study. An overgeneralization problem also occurred with the selection of a low number of clusters. For example, examination of the maps displaying the low numbers of clusters, showed that too much information was lost -- especially with respect to mother tongue and home language.

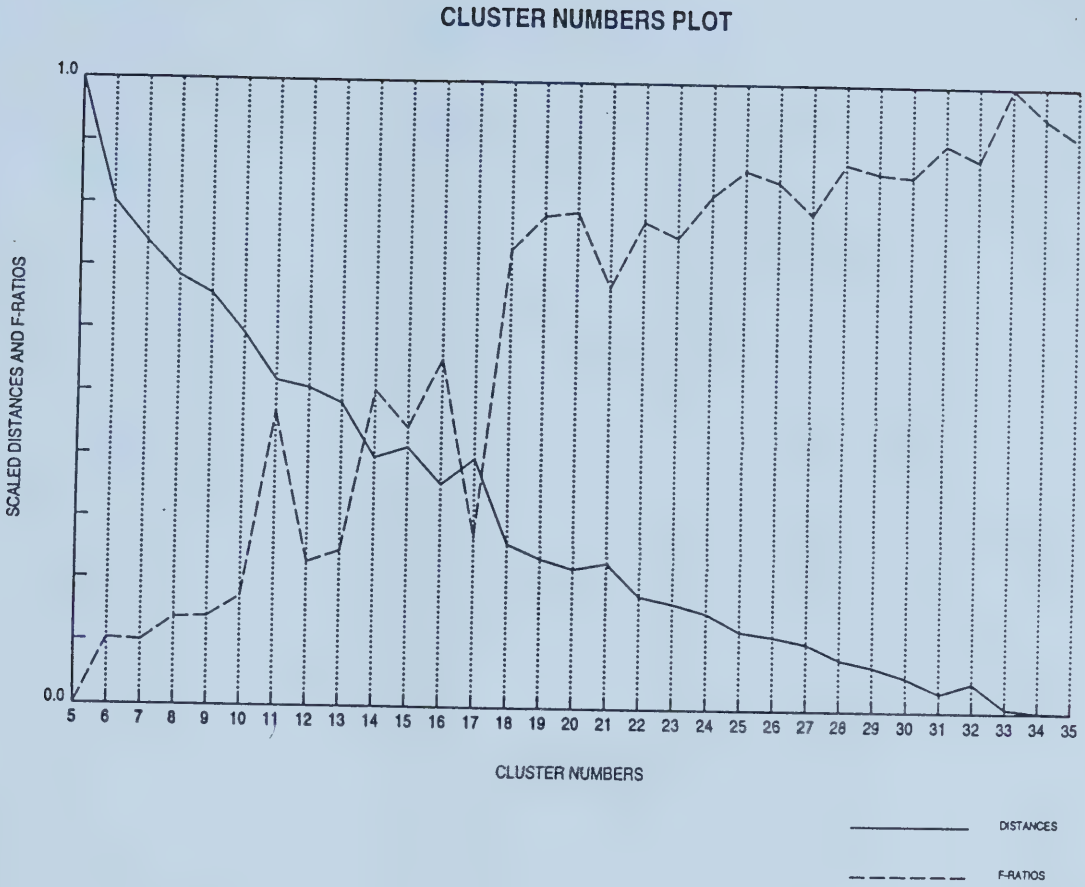

Figure 1. Cluster numbers versus F-ratio graph for ethnic origin. Peaks indicates optimal clustering.

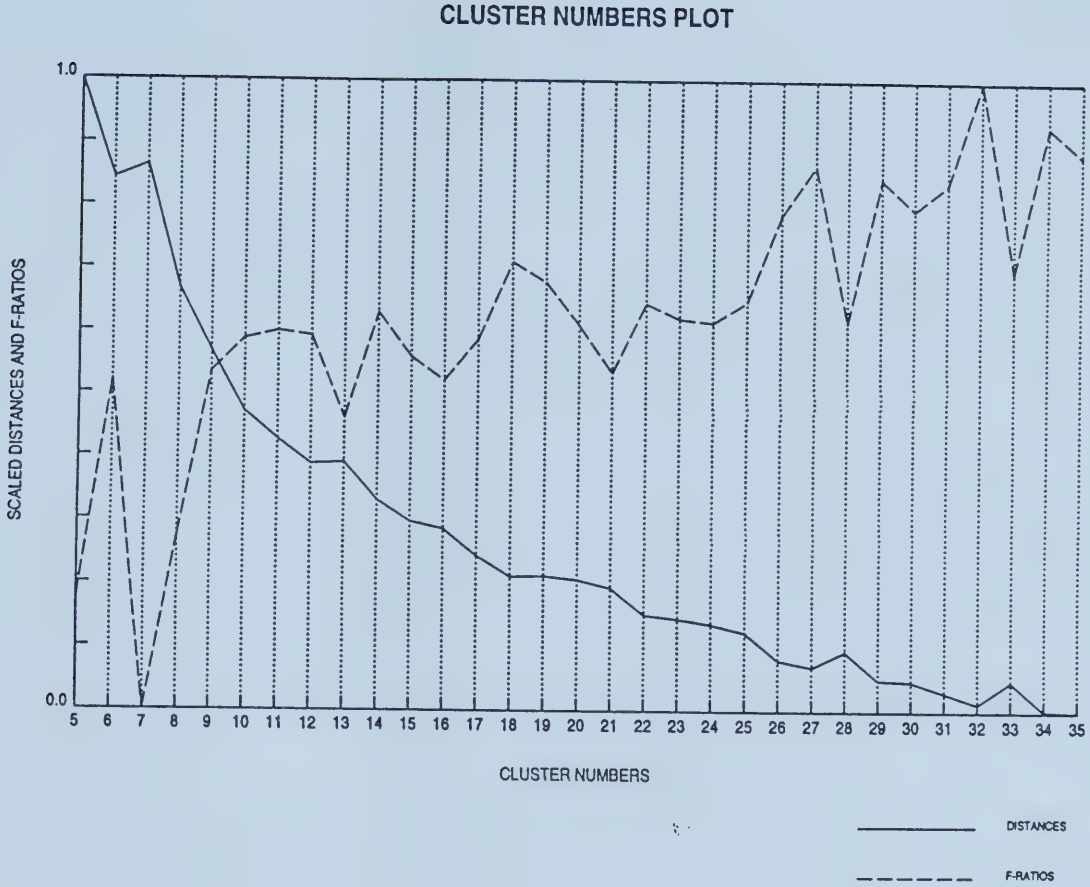

Figure 2. Cluster numbers versus F-ratio graph for mother tongue (excluding English).

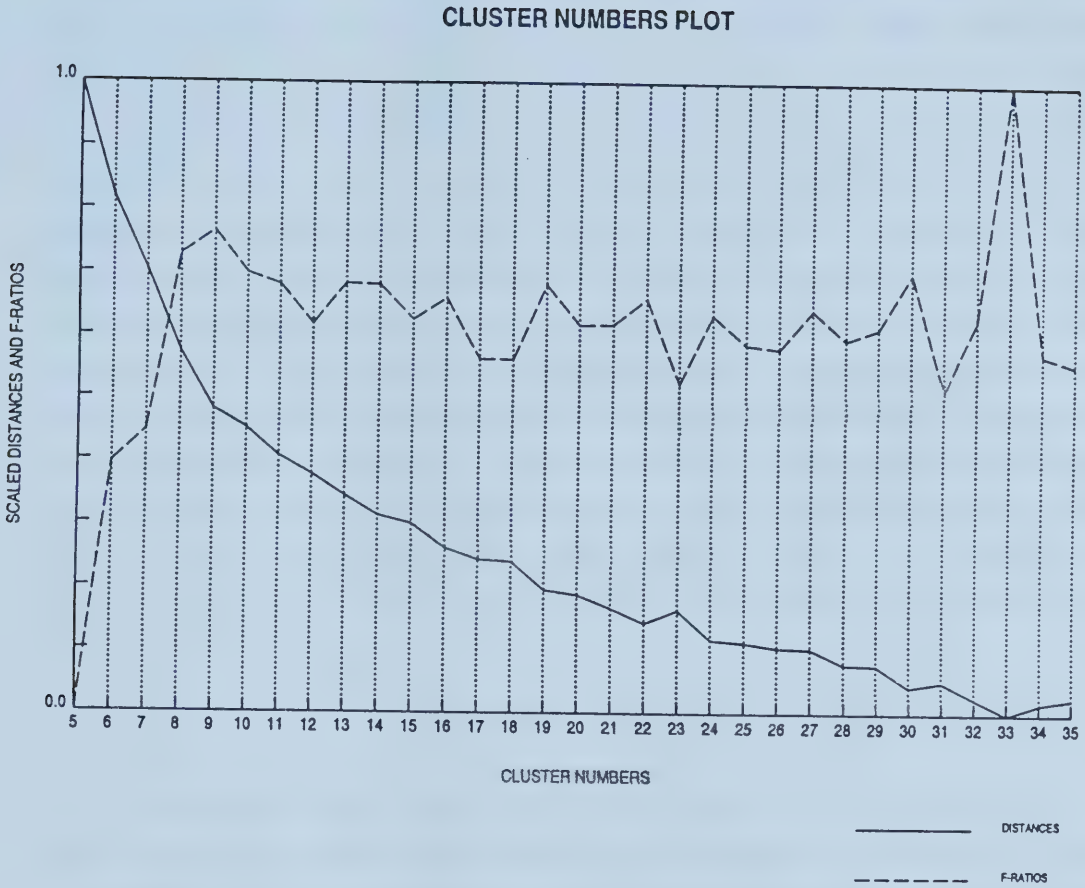

Figure 3. Cluster numbers versus F-ratio graph for home language (excluding English).

Since one of the major objectives of this thesis was the use of multivariate statistics as a tool to explore a more refined definition of Edmonton's ethnicity, the use of the maximum or minimum optimal number of clusters eliminated the possibility for comparison among data sets. In order to allow for comparability among ethnic origin, mother tongue, and home language, the cluster number plots were re-examined and natural breaks occurring at approximately the same location, somewhere between the high and low number of clusters, were identified. An optimal number of twelve clusters was finally selected and the associated cluster distribution mapped (see Figures 2.7, 2.8, and 2.9 in Appendix 2). The twelve clusters met the previously discussed criteria and provided the basis for subsequent analysis. The results of the cluster analysis (which generated three data sets of twelve clusters each) were then imported into the GIS data base. Analysis, classification and map creation was then performed using the *Arc/Info* system.

GIS Methodology

Because "the power of a GIS lies in its ability to analyze spatial and attribute data together" (Aronoff 1989), a number of sophisticated GIS analysis capabilities were employed in this research. Initially, map dissolve and overlay operations were used to create the additional data bases required for analysis and display. Once the data bases were compiled, integrated analysis of the spatial data and attribute data was performed using the data retrieval and data classification functions of the GIS. The preparation of analysis results for output was accomplished by invoking the output formatting capabilities of the GIS; the resulting maps were then plotted on an electrostatic color plotter. The principle GIS functions utilized in this research are briefly discussed below, followed by a discussion of final map design

and map production techniques.

Dissolve is a data generalization technique that allows the user to merge adjacent polygons (census tracts) which have the same value for a specified item (cluster number). Once the results of the cluster analysis were loaded into the GIS and linked to the data base (containing the spatial and non-spatial attribute data), a *dissolve* was performed on all three coverages (a data base of spatial and attribute data); ethnic origin, mother tongue and home language. One advantage of this generalization technique, is that the amount of data stored is reduced. For example, ethnic origin polygons (census tracts) were reduced from 167 to 65, the mother tongue polygons were reduced from 167 to 47, and home language polygons were reduced from 167 to 61. The dissolve technique also proved advantageous by automatically removing all census tracts that were not contained in the city of Edmonton. For example, census tracts contained in the original basemap of the Edmonton CMA, but not part of the urbanized core were eliminated and the census tracts comprising just the city of Edmonton remained.

Through the polygon dissolving process, the level of classification detail was reduced to make the underlying spatial pattern more apparent. Because the cluster analysis provided the basis for map classification (using twelve clusters), no complex classification scheme had to be invoked before the results could be mapped. Figures 3.1, 3.2 and 3.3 found in Appendix 3, show the results of the *dissolve* process.

Overlay is a GIS technique that merges overlapping polygons and their corresponding attributes from two data layers to create new polygons in an output layer. In other words, an overlay involves finding those areas where a certain set of conditions occur (or do not occur) simultaneously. For example, certain areas can be said to be culturally cohesive in terms of the Chinese if those polygons have Chinese as one of the predominant ethnic origins and also have Chinese as one

of the predominant mother tongues. Because ethnic origin and mother tongue are represented as separate data layers in the GIS, then polygon overlay is the process used to identify the locations where these conditions are congruent.

Several overlays were performed: ethnic origin with mother tongue, ethnic origin with home language, mother tongue with home language, and ethnic origin and mother tongue with home language. Once all overlays were complete, the data bases required classification before mapping could begin.

Classification is a technique that allows the user to classify a set of features as belonging to a particular category. In the case of an individual data layer (ie. ethnic origin), classification involves the assignment of a class name or number to each polygon as an attribute. For example, the classification of predominant ethnic origins, the class names might be Chinese, Italian, British, and French etc. In this case, the classification process involves examining the attributes for a single data layer and assigning a new attribute -- the new class name.

With multiple data layers (the results of the overlay operations), classification is similar to the single data layer classification process, but more complex. In the case of multiple data layers, polygons are classified based on criteria involving all data layers. For example, a polygon can be classified as being culturally cohesive for the Chinese, if the polygon contains a defined proportion of Chinese ethnic origin, mother tongue, and home language.

Because Edmonton's ethnic diversity is complex and the principles defining that diversity are even more complicated, the application and analysis of various mapping thresholds were undertaken before any final decisions about data classification could be made. The simplest cases involving the single data layers (eg. ethnic origin, mother tongue and home language) were tested first. This involved an examination of the classification resulting from applying a

particular threshold. In selecting which groups or languages were to be classified and mapped, an initial criterion was used. This criterion can be stated as follows; an individual ethnic group or language must constitute more than 1 per cent of the population (ie. more than 1 per cent of all single origins or more than 1 per cent of all non-official languages) and be greater than the average for the city of Edmonton (for each individual group or language), in order to qualify for inclusion. Once these data were classified and mapped, the 1 per cent threshold produced distributions that were too detailed. When this 1 per cent threshold was applied to ethnic origin, as many as ten single ethnic origins defined the composition of cluster 3 (see "Cluster 3 Leading Single Ethnic Origins" in Appendix 4). For a detailed listing of all ethnic groups and languages at the 1 per cent threshold see Appendix 4.

The same criterion used on the single data layers was also applied to a multiple data layer. At greater than 1 per cent of the population, and greater than the city average, the data layer containing the results of an overlay process (compilation of ethnic origin, mother tongue and home language) was mapped and analyzed. The use of the 1 per cent threshold on a multiple data layer, also provided too much detail; for example, at this level, thirty-three categories containing an average of two or more ethnic groups had to be mapped (see Map 1).

Applying a relatively high threshold (10 per cent) also proved to be of little value in classifying the data. At 10 per cent, the threshold produced distributions that contained too few ethnic origin or language groups to explicate Edmonton's ethnic diversity. For example, in all three data sets, only four groups; the British, German, Ukrainian and Chinese, typically exhibit populations greater than 10 per cent, thereby eliminating a vast majority of Edmonton's ethnic populations and languages.

To ensure a more balanced representation of Edmonton's ethnic populations, mother tongues, and home languages, a 5 per cent threshold was selected. In selecting which groups or languages were to be classified and mapped, the criterion used was that an individual ethnic group or language must constitute more than 5 per cent the population (ie. more than 5 per cent of all single origins or more than 5 per cent of all non-official languages) and be greater than the city average (for each individual group or language), in order to qualify for inclusion.

Once this application and analysis of the results of various thresholds was completed and the representative criterion selected, the data could then be classified. The classification of the three single data layers (ethnic origin, mother tongue, and home language) into twelve categories (as previously determined by the cluster analysis) was accomplished by adding a new item to the attribute table (eg. class), and performing a series of queries on each individual data set to fill the new item with the appropriate class. This involved a two step process. First, a macro (AML) was written and run on each individual data layer incorporating the following threshold criterion:

1. All variables less than or equal to 5 per cent were excluded.
2. All variables less than or equal to the city average for each individual ethnic group or language were excluded.

The residual variables were then examined and the composition of each category or cluster (eg. Chinese and East Indian) was then determined. Once the cluster composition was determined, the polygons were then classified based on that composition. For example, if cluster 1 was determined to be composed of individuals with an Ukrainian ethnic origin, then all polygons in cluster one containing Ukrainian as the predominant ethnic origin would then be classified as Ukrainian (eg. class =

Ukrainian). This classification procedure was used on all three data layers and the data was classified accordingly.

The classification procedure used to process the multiple data layers (the results of the overlay operations) was similar to the procedures for processing the single data layers, but was much more complex. The multivariate databases required additional processing before the classification was undertaken. The thresholding program was run on each of the four individual data sets (ethnic origin with mother tongue, ethnic origin with home language, mother tongue with home language, and ethnic origin and mother tongue with home language) but had to be modified to include some exceptions. For example, because Statistics Canada "asks" individuals of East Indian descent to report a single language (ie. Punjabi, Hindi, Gujarati, and Urdu) these inconsistencies in the data had to be accounted for. If any of combination East Indian languages summed to greater than 5 per cent, they were <u>not excluded</u> (included).

After all exclusions were made, the residual variables for each multiple layer data set were then examined to determine the number of classes and their composition. Each polygon in each data set was then classified according to whether a certain set of conditions occurred (or did not occur) together. For example, if ethnic origin was Ukrainian, and mother tongue was Ukrainian, and home language was Ukrainian, then the category was classified as Ukrainian. If one of those conditions was not met, then the polygon was classified as a polygon lacking cultural cohesion for that particular ethnic group. Once the classification process was complete and all data sets properly compiled, the map design and production of several multivariate maps that help to define Edmonton's ethnic diversity could commence.

Final Map Design

Because *"the goal of cartographic design is to convey thought in graphic form as simply as possible"* (Dent 1990), the overall objective of the map composition process in this research was to produce multivariate maps which displayed the spatial distribution of Edmonton's ethnic diversity in a clear, legible, and appealing manner. This initially involved the choice of an appropriate mapping technique that simply and comprehensibly portrayed the multivariate data. Choropleth mapping was chosen as the most appropriate mapping technique for representing the data because the basic geographic units to be mapped were comprised of a polygons or area observations (census tracts).

In order to ensure internal and external base data consistency among all the multivariate maps, a single mapping macro (AML) was written and then modified accordingly to produce each individual map. The mapping macro generated the same internal base data (census tracts boundaries and partial representation of the transportation network) for each multivariate map and provided the "locational framework for the thematic mapping" (Fitzsimons 1985). The same mapping macro also produced external base data consisting of the source indication, neatlines, and borders. Because all the external base data required different explanatory and contextual information for each individual map, the mapping macro had to be modified for each run. These modifications included specific titles, notes and legends.

Great care went into placement and design of map legends because they are important devices for conveying information and are the key to reading the highly detailed maps produced in this research. All the legends were prominently positioned in each map and plotted large enough to aid in the process of the continual consultation required to read each map. To make the legends clear and map analysis less complicated, a

suitable color scheme was required to represent the large number of classes or categories contained in the legends. The colors for the legends were chosen to ensure each color was as visually distinguishable as possible and clearly perceived as different. Labels were added to the color shading of the legend in order to assist in visually sorting the large number of colors.

The color scheme was also constructed in such a way to ensure consistency among maps. For example, the same color (eg. red) was chosen to represent the same class or category (eg. Chinese) on each and every multivariate map produced. In addition to the same color, if possible, a variation of that color (eg. light red) was also selected to symbolize that particular group residing in a relatively large concentration with other groups (eg. Chinese and Italian). The final result of these cartographic choices and the map composition process, are seven multivariate maps that clearly portray Edmonton's ethnic diversity and ethnic group cultural cohesion in detail.

CHAPTER 4
ANALYSIS

This chapter examines the ethnic diversity and cultural cohesion of Edmonton's ethnic population in 1991. Summary tables of city averages of the various ethnic groups, mother tongues, and home languages found in Edmonton is discussed first. Following the summary tables is a discussion of single category maps illustrating the geographical distribution of predominant ethnic origins, mother tongues, and home languages within Edmonton. Two-category maps (graphic results of overlaying two data layers) are discussed next. The final map product (graphic result of overlaying ethnic origin with mother tongue and home language) is discussed last.

Major Ethnic Groups, Mother Tongues, and Home Languages

The city of Edmonton is one of the most ethnically diverse cities in Canada. Entropy index values (based on ethnic origin) as calculated by Bourne *et al.* (1986), show that Edmonton's ethnic diversity in 1981 (0.85) was exceeded by only one city -- Winnipeg (0.86). As indicated by Bourne *et al.* (1986), Edmonton is typical of most large prairie cities having a relatively small British majority, and relatively large European minorities.

In the census of 1991, among those (72 per cent) who declared a single ethnic origin other than British, German and Ukrainian constituted almost 22 per cent of Edmonton's ethnic population (Figure 4). The next four largest ethnic groups; Chinese, Canadian, French and Aboriginal, together represented an additional 22 per cent of Edmonton's ethnic groups. As shown in Figure 4, the remaining single ethnic origins, representing more than 1 per cent of Edmonton's ethnic population, trace their origins to Europe or Asia and combine to form a further 18 per cent of all single ethnic origins.

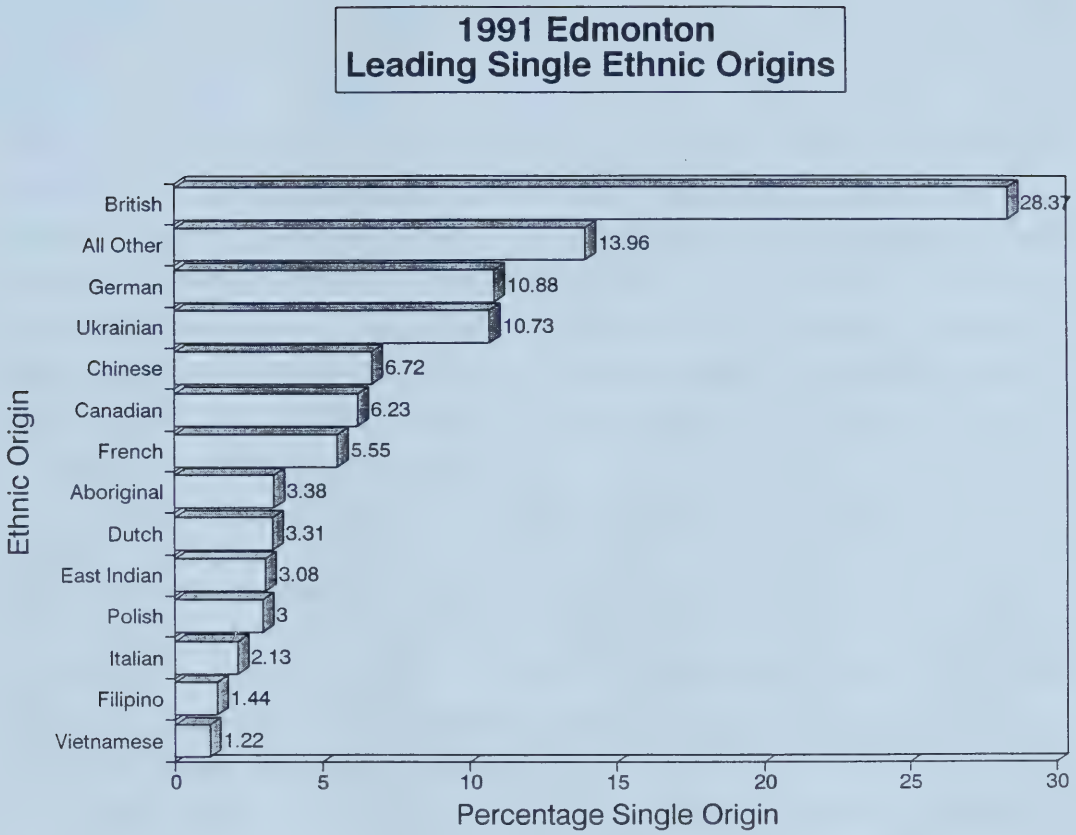

Figure 4. Leading single ethnic origins in Edmonton in 1991.

In 1991, persons who had a mother tongue other than English, Chinese was the most numerically dominant language and comprised 17 per cent of all non-official languages surveyed in Edmonton (Figure 5). Similar to the ethnic origin category, where persons of German or Ukrainian backgrounds were numerically dominant, the same pattern was true with mother tongue. Persons with a German or Ukrainian mother tongue together combined to form 29 per cent of all non-official responses. The remaining twelve mother tongues consisted of a diverse array of languages, representing greater than 1 per cent of all non-official languages, and together constituted an additional 39 per cent of all non-official languages. Persons with non-English mother tongues, also had sizable ethnic origins (greater than 1 percent of all single origins) except for five languages: Spanish, Arabic, Portuguese, Cree, and Hungarian.

Similar to the mother tongue category, reported in 1991, Chinese was also the most numerically dominant non-English home language spoken in Edmonton, comprising over 30 per cent of all non-official languages (Figure 6). The next four largest language groups: Polish, Vietnamese, Punjabi, and Spanish, together represented over 27 per cent of all non-official home languages spoken.

Unlike the ethnic origin and the mother tongue category, where German and Ukrainian were numerically dominant, in the home language category, the proportion of persons speaking German (4.69 per cent) or Ukrainian (4.02 per cent) in the home was relatively low, comprising only the seventh and eighth language category respectively. Each of the following nine languages: Italian, Arabic, Portuguese, Filipino, Hindi, Korean, Gujarati, Khmer and Urdu, comprised between 3.86 per cent and 1.33 per cent of Edmonton's non-English home languages spoken in 1991. Of those nine home languages, only five: Italian, Filipino, Hindi, Gujarati and Urdu, had sizable ethnic populations in Edmonton in 1991.

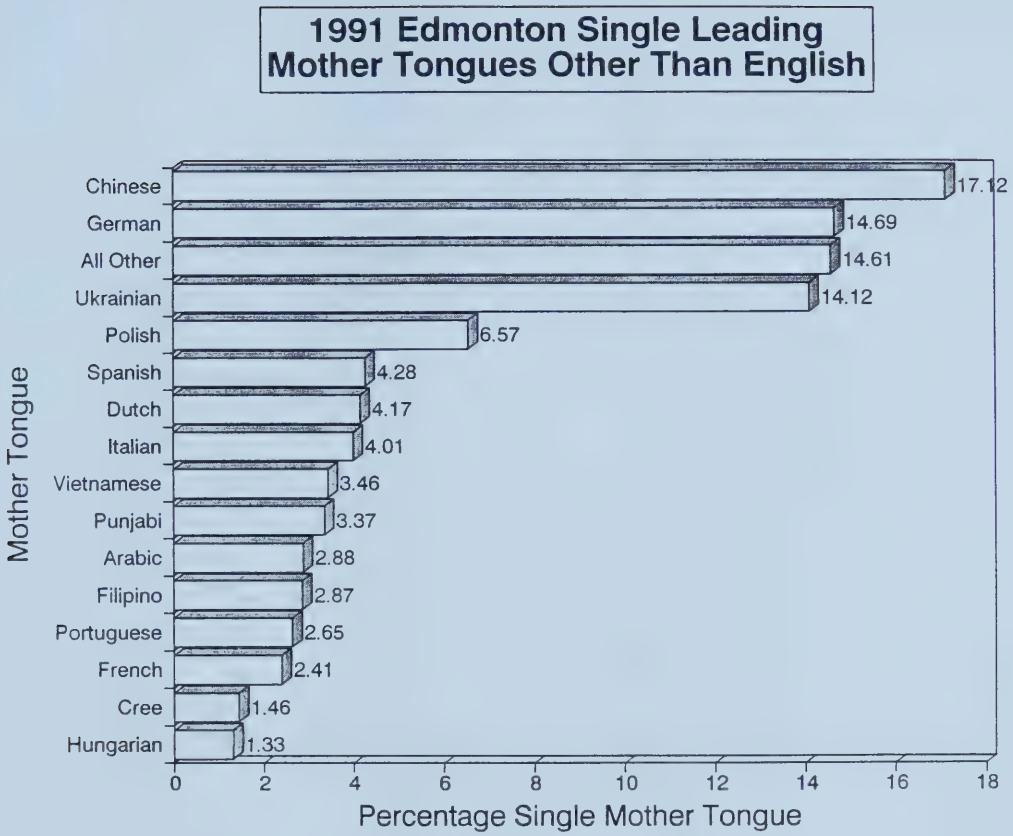

Figure 5. Leading single non-English mother tongues in Edmonton in 1991.

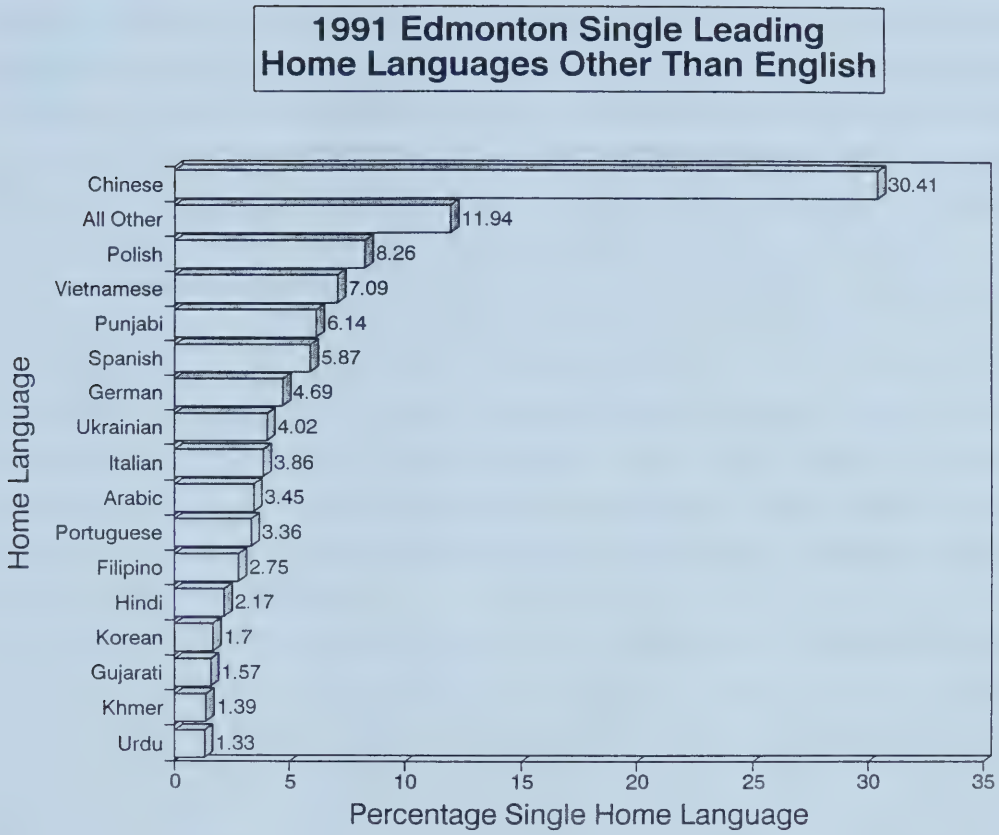

Figure 6. Leading single non-English home languages in Edmonton in 1991.

Single Category Maps

Because residential concentration is a significant factor in ethnic group cohesion and "can be considered as a kind of socio-geographic phenomenon, representing an *objective* face of ethnic social organization and requiring no social or social-psychological explanations" (Herberg 1989), the focus of this analysis was to examine only the clusters showing high levels of residential concentration. To better grasp the range and extent of ethnic diversity within Edmonton, it also is useful to examine the ethnic composition of the residentially concentrated clusters mapped in terms of their predominant ethnic origins, mother tongues, and home languages.

The initial map titled "Predominant Ethnic Origins in Edmonton", exemplifies the diverse ethnocultural composition of Edmonton (Map 2). For example, of the twelve clusters mapped, thirteen different ethnic origins, in at least groups of two or more, appear at or above threshold concentrations within each cluster.

One note of caution, to avoid a simplistic interpretation of Map 2, almost all of the twenty-nine single ethnic origins (below the mapping thresholds) analyzed in this study were present in every single cluster mapped. The British for example, were represented in all twelve clusters, but at relatively lower concentrations. Although most ethnic origins were widely dispersed throughout Edmonton in each and every cluster, a few were not. For example, the Finnish were absent in clusters 2, 10 and 11. Other exceptions included individuals of Lebanese and Jewish origin. For instance, there was no Lebanese representation in cluster 4 and no individuals of Jewish origin were found in cluster 11. One other note in regard to Map 2, the ethnic composition of cluster 9 and 10 appear the same (ie. Chinese and East Indian) as a result of the mapping thresholds, but that is not the case when the third ethnic group is examined. At values below

the mapping thresholds, for instance, the third ethnic group found to reside in cluster 9 was Filipino. Whereas, in cluster 10, the third ethnic origin was Korean. (see "Cluster 9" and "Cluster 10" in Appendix 4).

In addition to Edmonton's diverse ethnocultural makeup exemplified in Map 2, considerable residential concentration (a spatial concentration of contiguous census tracts with no more than one census tract removed) is also revealed. For example, of the twelve clusters mapped, one third demonstrate relatively high levels of residentially concentrated ethnic communities. In 1991, the highest levels of territorial concentration in Edmonton can be found in cluster 12, an inner city concentration consisting of seven census tracts where individuals of Chinese, Vietnamese, Aboriginal, and Portuguese ethnic origins resided at proportions well above the city average for each individual ethnic group (Figure 7). The second cluster showing a high proximity of residence was cluster 12, found on Edmonton's southeast periphery -- Millwoods. Cluster 12 is comprised of eight census tracts, where persons of East Indian, and to a lesser extent, Canadian and Chinese origin resided (Figure 8). The final cluster discussed showing a relatively high level of closeness of residence, is cluster 2 and includes five census tracts located in Edmonton's northern peripheral neighbourhood of Castledowns. In 1991, cluster 2 was comprised of relatively high concentrations of individuals with Chinese, Ukrainian, or Italian ethnic backgrounds (Figure 9).

Similar to Map 2, where thirteen different ethnic origins were mapped, the next map titled "Predominant Mother Tongues in Edmonton" also exemplifies Edmonton's ethnic diversity (Map 3). For example, of the twelve clusters mapped, fourteen different mother tongues appear at or above threshold concentrations within each cluster, in at least groups of two, and as many as seven distinct mother tongues (Map 3). In 1991, all these non-English mother tongues also had sizeable

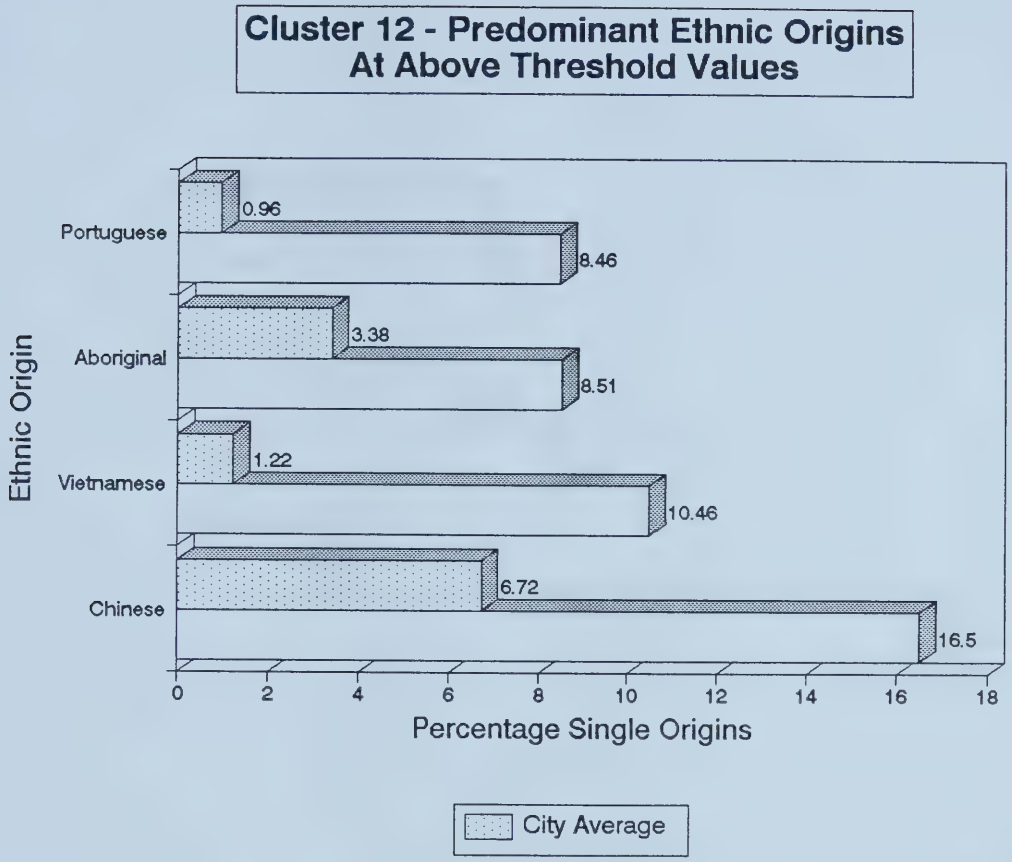

Figure 7. Ethnic origins above (threshold values) versus city average for cluster 12.

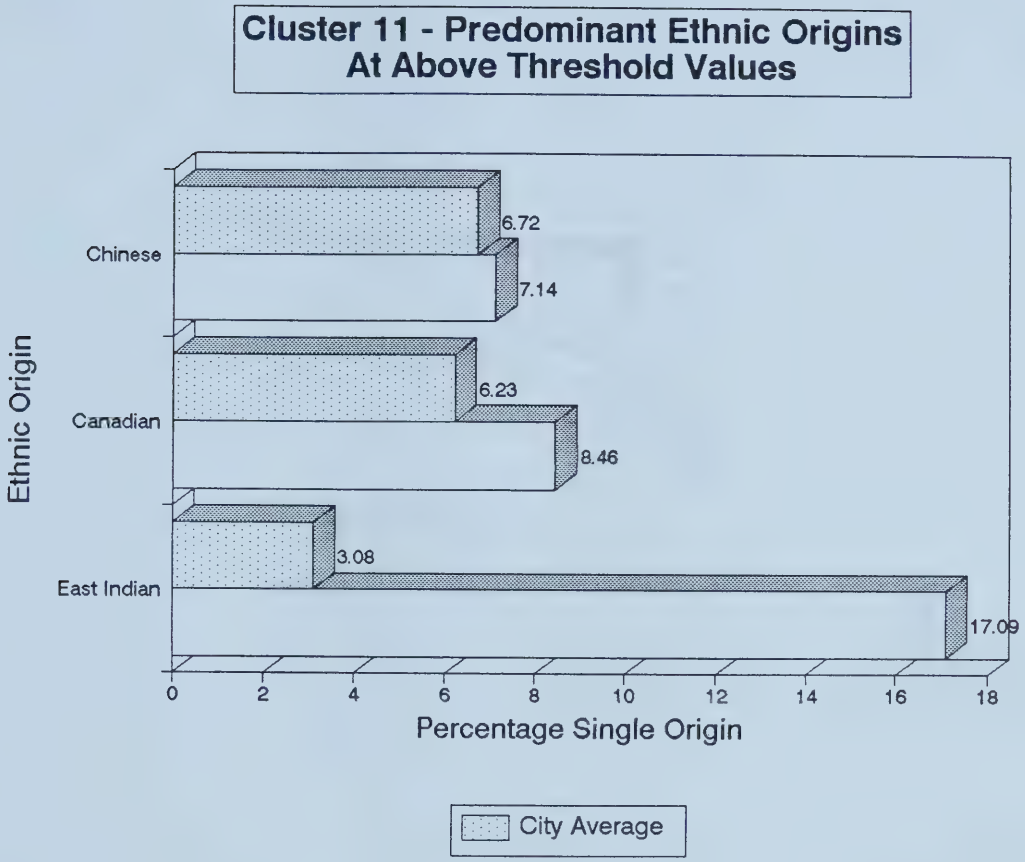

Figure 8. Ethnic origins (above threshold values) versus city average for cluster 11.

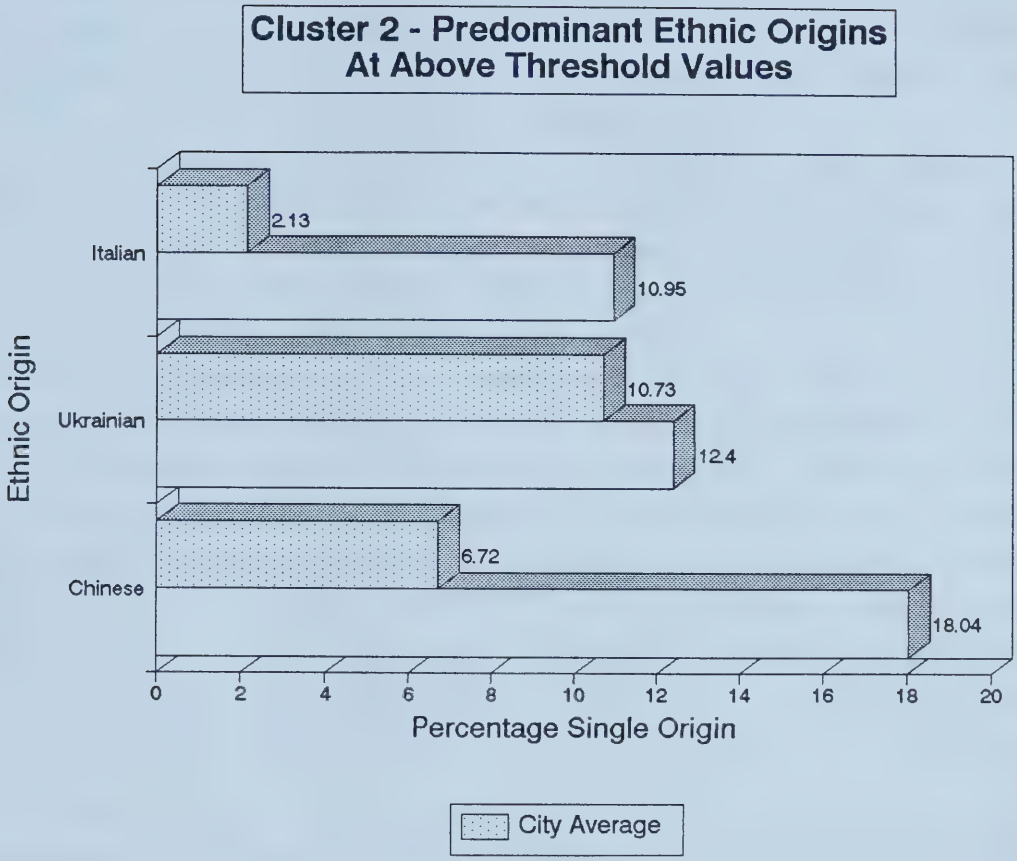

Figure 9. Ethnic origins (above threshold values) versus city average for cluster 2.

ethnic populations except for four languages: Spanish, Filipino, Russian and Arabic. Unlike the ethnic origin category, where the majority of ethnic origins were present in every single cluster, in the mother tongue category several clusters lacked representation from many of the mother tongues analyzed. Of the twenty-seven non-English mother tongues analyzed, between one to six mother tongues were absent in the twelve clusters analyzed (see Appendix 4).

When Map 3 is examined for patterns of high levels of residential concentration, the spatial patterns parallel those found in Map 2. For example, an examination of non-English mother tongues also reveal residentially concentrated inner city, Millwoods, and Castledowns clusters. The inner city cluster (cluster 12) is comprised of two census tracts dominated by individuals declaring a non-English mother tongue of Vietnamese, Polish, or Spanish (Figure 10). The Millwoods cluster (cluster 2), consisted of nine census tracts, where non-English mother tongues of Punjabi, and to a lesser extent, Spanish and Filipino resided at above average proportions (Figure 11). The Castledowns cluster (cluster 11) includes ten census tracts consisting of relatively high concentrations of individuals with Chinese, Arabic, or Italian mother tongues (Figure 12).

The final single category map, titled "Predominant Home Languages In Edmonton" also demonstrates Edmonton's ethnic diversity (Map 4). For example, of the twelve clusters mapped, fourteen distinct non-English home languages appear above threshold values in at least groups of two and as many as five languages. In 1991, these fourteen non-English home languages also had sizeable associated ethnic origins and mother tongues except for two languages: Dutch and Russian. Notable is the fact that when Edmonton's predominant home languages were mapped, Hindi and Khmer appear in relatively large concentrations in two of the twelve clusters in this map and not in either of the previous two maps.

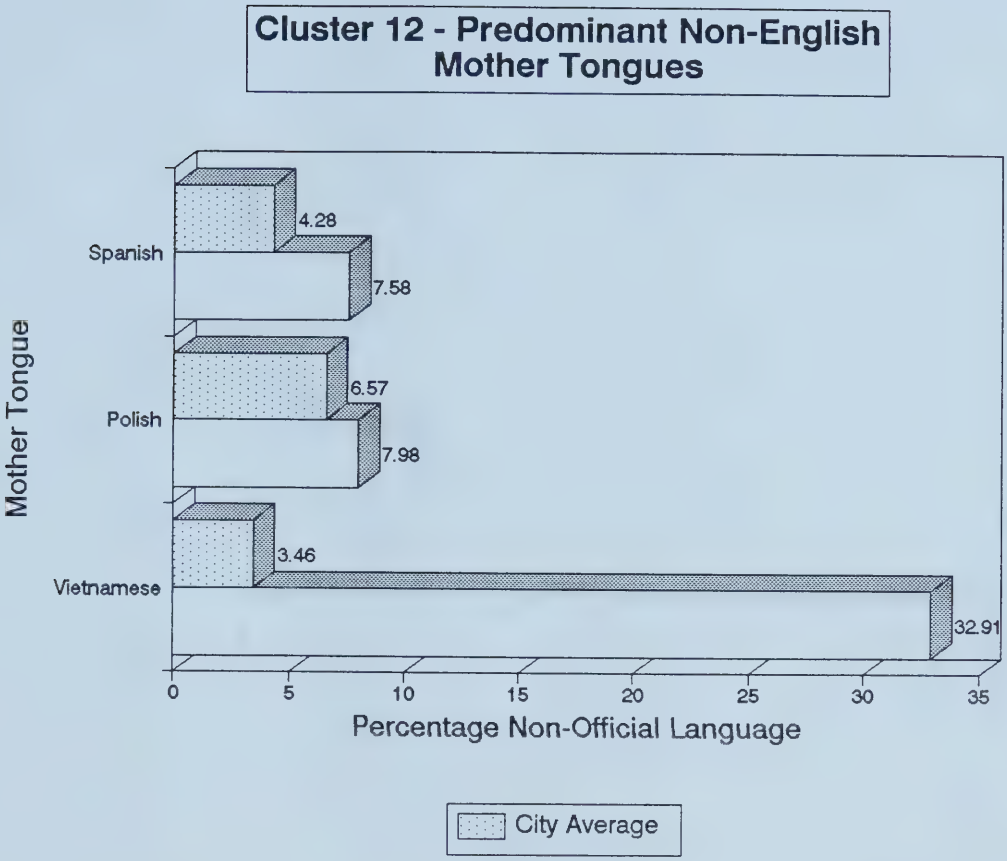

Figure 10. Non-English mother tongues (above threshold values) versus city average for cluster 12.

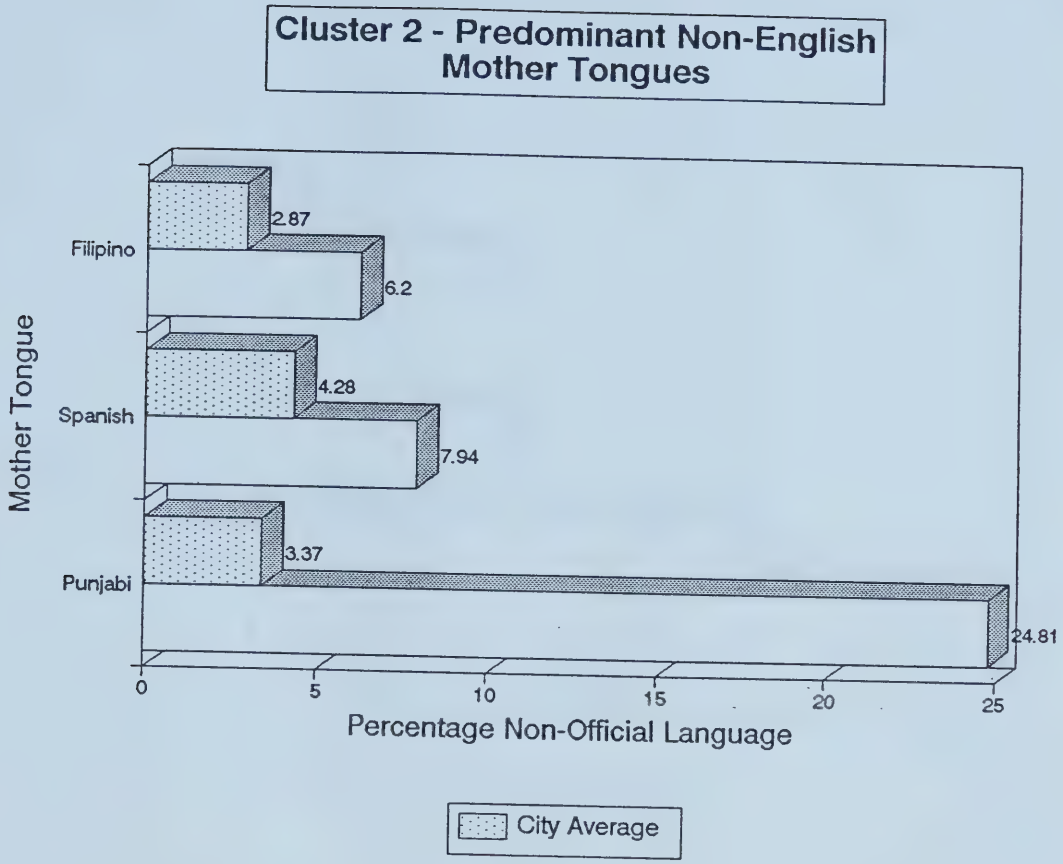

Figure 11. Non-English mother tongues (above threshold values) versus city average for cluster 2.

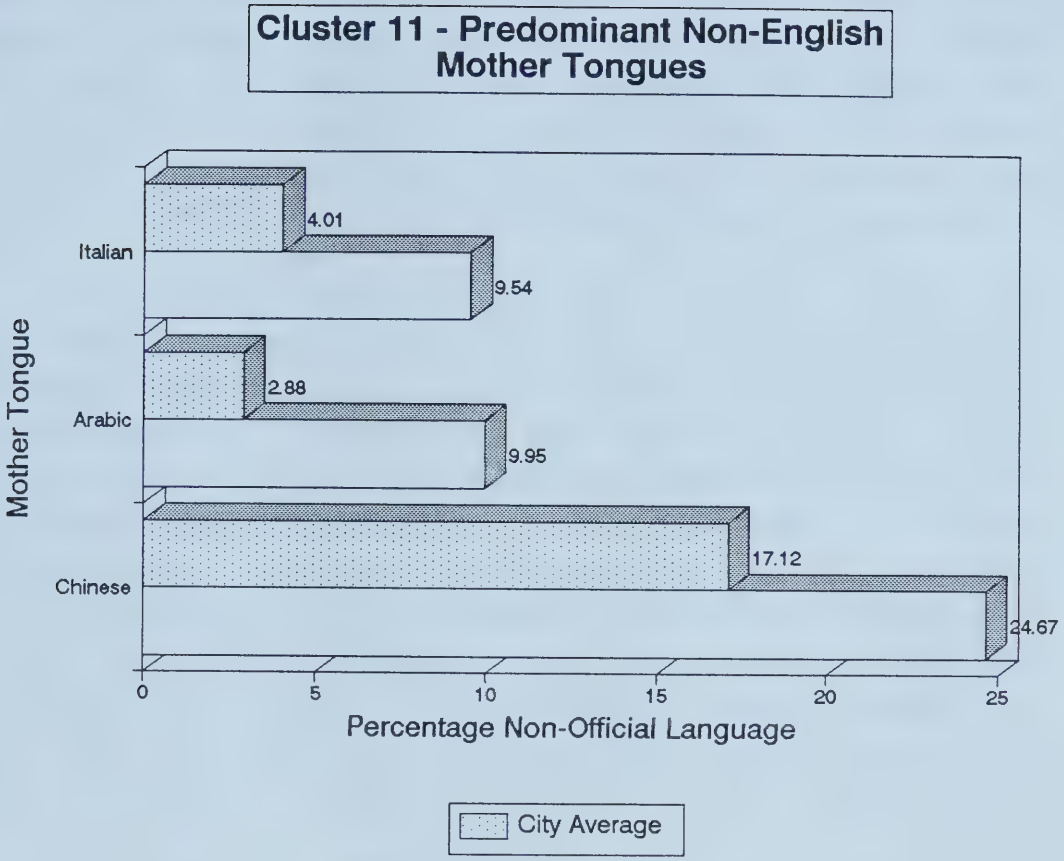

Figure 12. Non-English mother tongues (above threshold values) versus city average for cluster 11.

Although Map 4 displays a wide array of non-English languages spoken at home, these languages were not widely distributed throughout the clusters. Of the thirty-two non-English home languages analyzed in this research, at least two of the languages were not spoken at home in each of the twelve clusters mapped. Many of these clusters also lacked diversity with respect to home language. For example, the least diverse clusters were cluster 8, cluster 4, and cluster 2, where respectively twenty-two, fifteen, and fourteen, non-English home languages were not spoken at all in Edmonton in 1991.

When Map 4 is examined for spatial patterns of residential concentration, only two of the twelve clusters exhibit relatively high levels of territorially concentrated home languages. Paralleling the ethnic origin and mother tongue categories, the home language category map also depicts a residentially concentrated inner city and a Millwoods concentration. The inner city cluster (cluster 12), consisted of two residentially concentrated census tracts, dominated by individuals using Vietnamese, Khmer, or Spanish as their home language (Figure 13). The Millwoods cluster (cluster 4), included seven census tracts where persons spoke Punjabi, and to a lesser extent, Hindi or Filipino at home (Figure 14).

Two-Category Maps

Because "Language retention, as an index of the extent to which the ethnic or heritage language is still understood and used in speech, has been put forward as perhaps the single most important indicator of both Collective identity definition and ethnocultural cohesion" (Herberg 1989), the major objective of the two-category maps (graphic results of overlaying two data layers) was to identify the census tracts where an ethnic group's corresponding mother tongue or home language was maintained (at a level above threshold values for

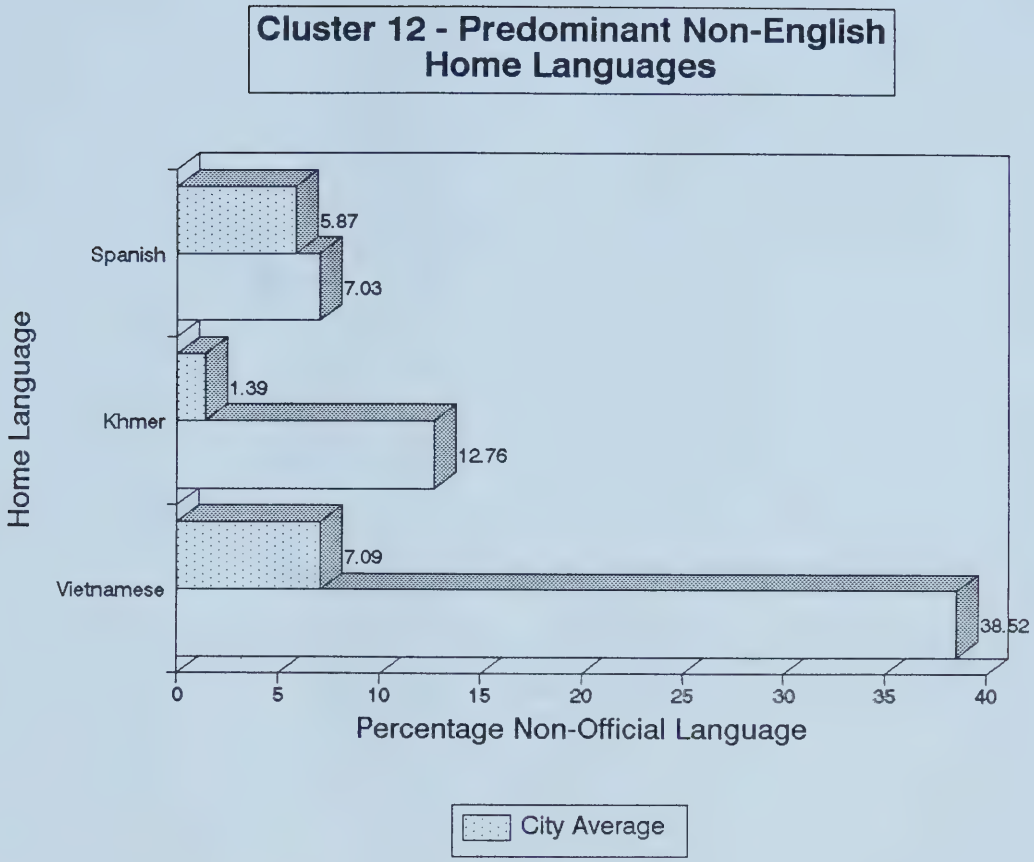

Figure 13. Non-English home languages (above threshold values) versus city average for cluster 12.

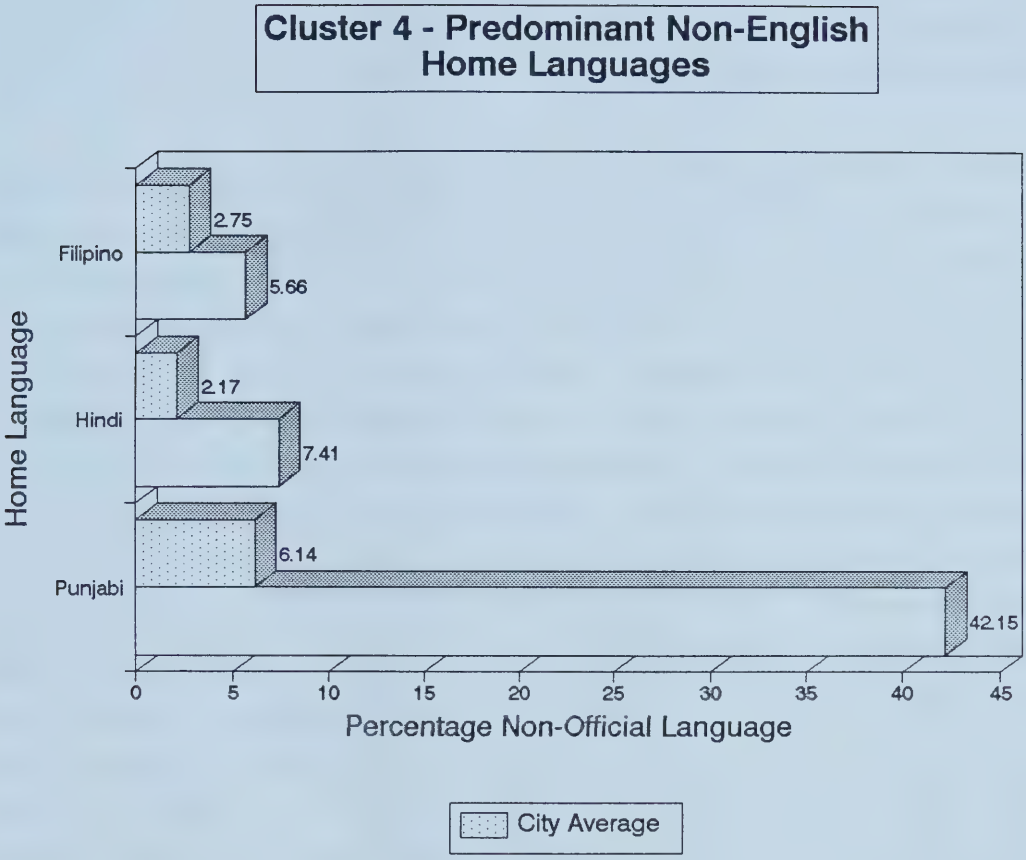

Figure 14. Non-English home languages (above threshold values) versus city average cluster 4.

each individual group or language). In addition to highlighting areas of significant language maintenance, the spatial distribution depicted on the two-category maps was also examined for areas exhibiting high levels of residential concentration because as Herberg (1989) states "the existence of high residential concentration enabled the concentration of ethnic group members necessary for continuing the daily use of the ethnic language".

The initial two-category map discussed titled "Culturally Cohesive Ethnic Origins and Mother Tongues in Edmonton" highlights the census tracts where an ethnic group's corresponding ethnic or heritage language (mother tongue) was still understood at the time of the census (Map 5). In 1991, 73 per cent of all census tracts comprising the city of Edmonton contained between one to four ethnic groups that retained their coinciding mother tongues. Of the twenty-nine different ethnic origins analyzed, twelve distinct ethnic groups where culturally cohesive in terms of mother tongue.

When the spatial distribution of Map 5 is examined, eleven of the nineteen classes of ethnic groups who retained their corresponding mother tongues demonstrated high levels of residential concentration. For example, of the eleven territorially concentrated classes, seven of them are located north of Edmonton's North Saskatchewan River in either the inner city or the Castledowns area. Closest to the central business district (CBD), was the first of three inner city concentrations of culturally cohesive ethnic groups. This area of concentration consisted of three census tracts situated adjacent to the CBD where of individuals of Chinese or Vietnamese ethnic backgrounds retained their corresponding mother tongues at proportions well above the city average for each individual language in 1991 (class 12). The second inner city area showing a high proximity of residence was two neighbouring census tracts where persons of Vietnamese or Polish origin maintained their corresponding heritage

languages (class 14). The last residentially concentrated inner city cluster consisted of two census tracts located on the north border of the Chinese and Vietnamese concentration, and included culturally cohesive individuals with Chinese, Vietnamese, Polish, or Portuguese ethnic backgrounds (class 19).

Located in north central Edmonton in the Castledowns area are four areas of residentially concentrated ethnic groups who understood their corresponding mother tongues at the time of the 1991 Census. The northernmost culturally cohesive concentration of ethnic groups showing a relatively high level of closeness of residence, was class 18 and included three census tracts located in Edmonton's northern peripheral neighbourhood of Castledowns. In 1991, class 18 was comprised of relatively high concentrations of individuals with Chinese, Lebanese, or Italian ethnic backgrounds who retained their corresponding mother tongues at above threshold values. Located on the south border of class 18, was one census tract which included individuals of French origin who maintained their heritage language and resided in close proximity to other members of their group (class 3). Situated on the west boundary of the culturally cohesive French, are two additional areas of significant ethnic language maintenance. The larger area included two census tracts containing relatively high proportions of Italians with significant heritage language maintenance (class 6) and the other adjoining area included one census tract where individuals of Chinese, Ukrainian, or Italian ethnic backgrounds were culturally cohesive in terms of their mother tongue in 1991 (class 17).

Located south of Edmonton's North Saskatchewan River are three residentially concentrated areas with relatively high ethnic language retention. Located closest to the river, was of one census tract where persons of German, French, or Polish origins had strong ethnic language preservation (class 15). Situated adjacent to Calgary Trail, was also one census tract

containing Polish individuals who were culturally cohesive in terms of their mother tongue in 1991 (class 5). The largest area of relatively high ethnic language retention included eight residentially concentrated census tracts located in Millwoods consisting culturally cohesive concentrations of East Indian or Filipino ethnic origins (class 13).

The second two-category map discussed titled "Culturally Cohesive Ethnic Origins and Home Languages in Edmonton" indicates the census tracts where an ethnic group used their corresponding ethnic language as the normal medium of communication in the home in 1991 (Map 6). Sixty-nine per cent of all census tracts comprising the city of Edmonton included between one to three different ethnic groups who routinely spoke their corresponding ethnic language (at a level above threshold values) at home. Of the twenty-nine different ethnic groups analyzed, eleven groups where culturally cohesive in terms of home language.

When Map 6 is examined for patterns of residential concentration, eight of the fifteen classes of ethnic origins who routinely spoke their ethnic language at home, exhibited relatively high levels of territorial concentration. For example, of these eight territorially concentrated classes, six of them were located north of Edmonton's North Saskatchewan River in either the inner city or in north central Edmonton. The largest of two inner city concentrations of culturally cohesive ethnic groups (in terms of home language), consisted of five census tracts situated east of the CBD, where in 1991 individuals of Chinese, Vietnamese or Portuguese ethnic backgrounds usually spoke their corresponding ethnic language at proportions well above the city average (class 15). The other inner city concentration was two neighbouring census tracts located north of the CBD, where persons of Vietnamese origin spoke Vietnamese at home (class 6).

Located away from the CBD were four areas of

residentially concentrated ethnic groups in north central Edmonton who usually spoke their ethnic language at home. The northernmost culturally cohesive concentration (in terms of home language) of ethnic groups was one census tract located in Edmonton's northern peripheral neighbourhood of the Lake District (class 13). In 1991, this Lake District census tract was comprised of relatively high concentrations of individuals with Chinese, Ukrainian, or Italian ethnic backgrounds who spoke their corresponding heritage language as the usual medium of communication in the home. Located on the west boundary of the Lake District was one census tract where persons of Chinese, Lebanese, or Italian origin, who continued use of their ethnic tongue at home (class 14). Located on the southwest corner of the Lake District, was one census tract which included French individuals who routinely spoke French at home (class 3). Situated on the east boundary of the French speaking census tract, were two census tracts where persons of Italian or Ukrainian ethnic backgrounds who routinely spoke Italian or Ukrainian respectively at home (class 11).

Located south of Edmonton's North Saskatchewan River were two residentially concentrated areas with relatively high proportions of individuals who normally spoke their ethnic language at home. Adjacent to the river and located north of Whyte Avenue, was one census tract where persons of German or French origin used their corresponding ethnic language as the normal medium of communication in the home in 1991 (class 9). The southernmost and largest area of residentially concentrated census tracts containing individuals who routinely spoke their coinciding ethnic language at home was located in Millwoods. This concentration included seven census tracts with culturally cohesive concentrations (in terms of home language) of individuals with East Indian or Filipino ethnic backgrounds (class 12).

"Ordinarily, if the ethnic language has not been

maintained, it would be impossible to have the ethnic language as the home-use language" (Herberg 1989), therefore the purpose of the final two-category map discussed titled "Culturally Cohesive Languages in Edmonton" was to use the map to insure that an ethnic home language could not be used at home if the corresponding mother tongue was not maintained. Because the final comprehensive map includes the results of the cross analysis of mother tongue and home language, Map 7 is not be discussed here. A map showing those census tracts where ethnic languages that retain both their corresponding mother tongues and home language (excluding English) at proportions above threshold values is shown in Map 7.

Comprehensive Map

In addition to highlighting significant areas of residential concentration, the major purpose of the comprehensive map titled "Culturally Cohesive Ethnic Groups in Edmonton" (Map 8) was to identify the census tracts where both an ethnic group's mother tongue and home language (both excluding English) was maintained at above threshold values (for each individual group or language). As suggested by Herberg (1989), "it is through the interaction of the various cohesion mechanisms that is of greater consequence to the ethnic community in producing a cumulative dynamic in ethnic group culture that goes beyond their individual effectiveness".

In 1991, 61 per cent of all census tracts that comprised the city of Edmonton included between one to three different ethnic groups who understood their mother tongue and routinely spoke it at home (at a level above threshold values). Of the twenty-nine ethnic groups analyzed in this research, nine ethnic groups were culturally cohesive in the two language cohesion factors -- 1. ethnic language retention, and 2. home use of the ethnic language.

When Map 8 is examined for individual ethnic trends of another ethnic cohesion factor, residential concentration, considerable ethnic differentiation was revealed among the various ethnic groups. For example, of the nine culturally cohesive ethnic groups mapped, the Portuguese had one of the highest concentrations of residence in 1991. Located north of the North Saskatchewan River, the Portuguese resided in two adjoining census tracts in central Edmonton. Also displaying a high level of territorial concentration were the Vietnamese. In 1991, the Vietnamese occupied seven contiguous census tracts on the north and west periphery of the CBD. The other ethnic group displaying a high level of residential proximity were the East Indians. Relatively high concentrations of individuals with an East Indian ethnic background, who in 1991 retained and routinely used their ethnic language, resided in nine residentially concentrated census tracts located in Edmonton's southeastern neighbourhood of Millwoods.

Exhibiting lower levels of residential concentration than Edmonton's culturally cohesive (in terms of ethnic language retention and use) Portuguese, Vietnamese, and East Indian populations, were six other culturally cohesive ethnic groups; the Italians, French, Polish, Germans, Ukrainians, and Chinese all exhibited varying levels of residential concentration. The Italians and the French demonstrated moderately high levels of residential concentration, while the Polish, Germans, Ukrainians, and Chinese showed relatively low levels of territorial concentration.

Of the two moderately concentrated ethnic groups, both the French and the Italians resided in two different residentially concentrated areas each. The culturally cohesive (in terms of language maintenance) French resided at a level above threshold values in one census tract in north Edmonton encompassing the Canadian Forces Base (137 Avenue and 97 Street) , and in one census tract located south of the North Saskatchewan River in the Bonnie Doon area (Whyte Avenue

and 75 Street). Also residing in two distinct areas of concentration, were persons of Italian ethnic origin who understood and spoke Italian in 1991. The culturally cohesive Italian population were present in a territorially concentrated area of six census tracts situated in north central Edmonton and a single census tract in northern Castledowns.

Least concentrated in residence in 1991 were the Chinese, Ukrainians, Germans, and Polish. The Chinese were the most widely dispersed culturally cohesive ethnic group, residing in thirty-eight census tracts extensively distributed throughout the inner city and the four *quadrants* of Edmonton's urbanized core. The second least residentially concentrated ethnic group, above threshold concentrations, were Ukrainians who retained and still used their heritage language in 1991. The culturally cohesive Ukrainians resided in twenty census tracts equally located between north and south Edmonton. Principally located south of the North Saskatchewan River, were the third and fourth least territorially concentrated culturally cohesive ethnic groups. In 1991, the culturally cohesive German and Polish ethnic communities resided in nineteen and nine census tracts respectively found predominately in the relatively older neighbourhoods of Edmonton's central southside.

CHAPTER 5
CONCLUSIONS AND FUTURE RESEARCH

The results of this research not only adds to the understanding of ethnic diversity and cultural cohesion in Edmonton, but also the statistical and cartographic techniques developed provide a useful new methodology for the compilation, analysis, and dissemination of census data in general. Overall, Edmonton was truly an ethnically diverse city with approximately one half of its twenty-nine ethnic origins, twenty-seven mother tongues, and thirty-two home languages, appearing at or above threshold concentrations (greater than the city average for each individual group or language and greater than 5 per cent of all single origins or greater than 5 per cent non-official languages) in all 142 census tracts analyzed and mapped from the 1991 Census.

Specific Conclusions

Through the use of multivariate statistics (cluster analysis) and the use of Geographic Information Systems (GIS), the distribution of ethnic diversity and ethnic group cohesion in Edmonton was successfully mapped and analyzed. The following is a list of specific conclusions found as a result of this research:

1. The highest degrees of residential concentration were found among ethnic groups with strong linguistic ties (eg. Vietnamese, East Indians and Portuguese).

2. An ethnic group did not have to be residentially concentrated to be a culturally cohesive ethnic community (eg. Chinese, German, Ukrainian, and Polish).

3. The Chinese were the most widely spatially distributed culturally cohesive ethnicity.

4. Residential enclaves were present in Edmonton in 1991; the strongest examples include Millwoods, inner city,

Castledowns, and north central Edmonton.

5. Native peoples lacked cultural cohesion because there was minimal language retention.

6. Residing in 61 per cent of all census tracts comprising the city of Edmonton, approximately one third of all ethnic groups facilitated cultural survival through the maintenance and use of their ethnic language.

7. Of the culturally cohesive ethnic groups found in Edmonton in 1991, approximately half resided with other culturally cohesive ethnic groups (eg. German and Ukrainian; Chinese, Vietnamese, and Portuguese; Chinese and Italian etc.)

8. Edmonton's Dutch population were culturally cohesive in terms of mother tongue retention but lacked cohesion because they failed to use their ethnic language as the normal medium of communication in the home.

9. Other ethnic groups were culturally cohesive in terms of ethnic language retention and use but were classified as lacking cohesion because the size of their populations were below threshold values. (eg. Lebanese or Filipinos)

Methodological Conclusions

The overall objective of this thesis was the development of a hybrid methodology that combined the use of multivariate statistics and GIS technology in mapping Edmonton's ethnic diversity. The following is a list of methodological conclusions found as a result of this research:

1. The use of cluster analysis allowed one to distinguish which ethnic groups were located in close proximity to other ethnic groups (eg. Filipinos with East Indians, Europeans with other Europeans, Chinese with the Vietnamese, Lebanese, Portuguese, or Italians etc.).

2. Ethnic group cohesion was determined successfully through the use of the spatial analysis capabilities of a GIS employing cross analysis techniques.

3. Integration of the census data and results of the cluster analysis in a single analysis was achieved successfully through the use of a GIS.

4. Multivariate mapping was a powerful methodology for the analysis and display of the spatially distributed multicomponent data.

Future Research

The results of this research provided valuable insights but raised questions which warrant future research. The following is a list of possible topics for future consideration:

1. Use pre-determined thresholds before running the cluster analysis. For example, only include variables (eg. ethnic origins) that were greater than a certain percentage of the population.

2. Use the higher resolution enumeration areas rather than census tracts as the initial level of data aggregation.

3. Add the additional ethnocultural variables available in the Census of Canada to the data base and explore other ethnic cohesion mechanisms to test for cultural maintenance (eg. religious affiliation).

4. After identifying the ethnically cohesive communities, administer a questionnaire to add additional data in order to employ all of Herberg's ethnic cohesion factors (eg. ethnic endogamy and institutional completeness etc.).

5. Trace one culturally cohesive ethnic group over time.

6. Test some form of "assimilation" theory such as Burgess' (1975) model of urban growth.

7. Focus on Millwoods or the inner city rather than the entire urbanized area.

8. Use discriminate analysis to assign and test group membership for the satellite communities of Sherwood Park and St. Albert.

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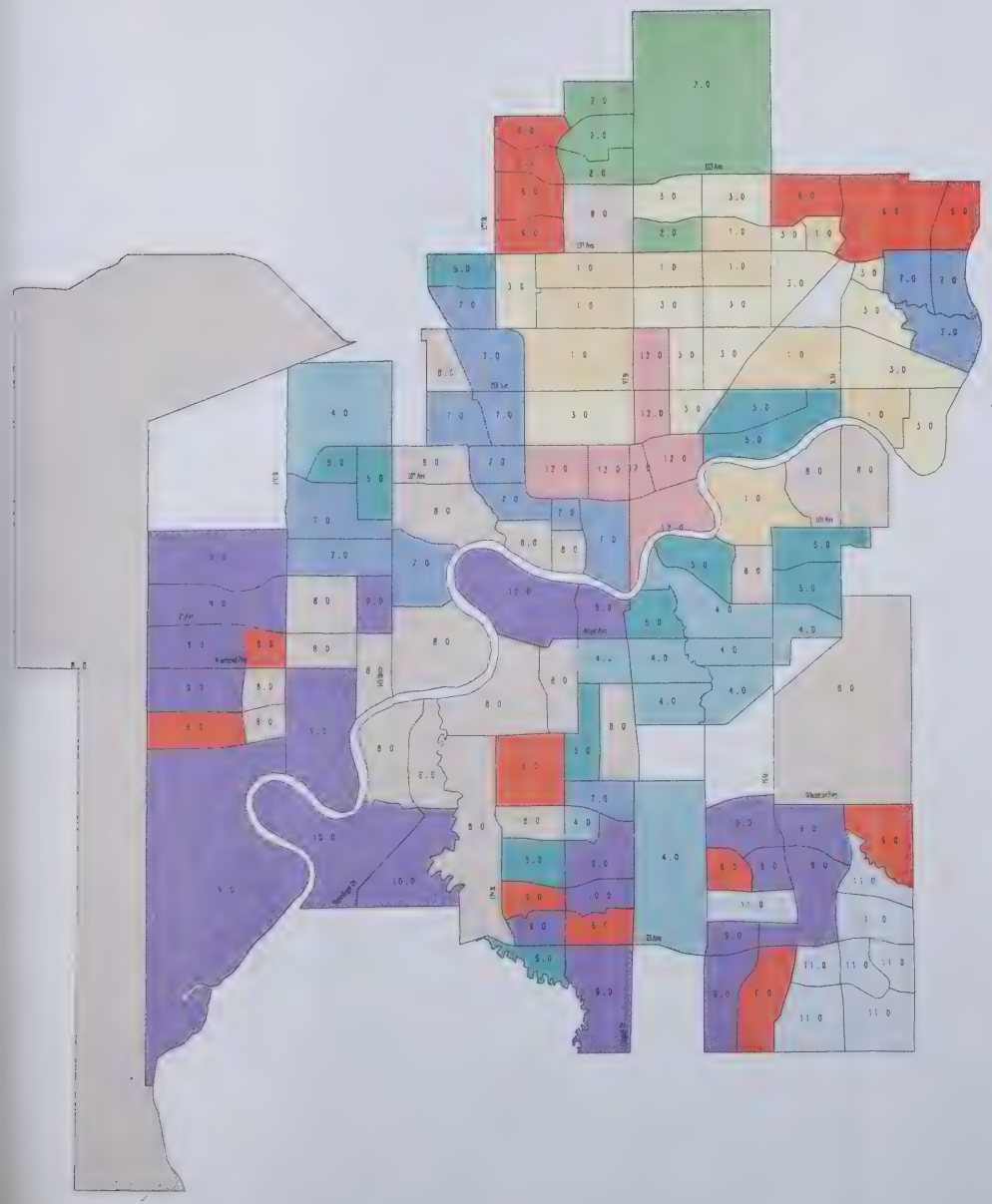
Culturally Cohesive Ethnic Groups in Edmonton

note: Culturally Cohesive Ethnic Groups refers to all ethnic origins who retain their corresponding mother tongues and home languages (both excluding English) at proportions greater than the city average (for each individual group) and greater than 1% (single origin or non-official language).

Key to Ethnic Origins

1. Chinese
2. French
3. Dutch
4. East Indian
5. Polish
6. Italian
7. Filipino
8. Lack of Cohesion
9. German & French
10. German & Polish
11. Ukrainian & Polish
12. Polish & Portuguese
13. Polish & Spanish
14. Polish & Dutch
15. Dutch & French
16. Italian & Lebanese
17. East Indian & Spanish
18. East Indian & Filipino
19. Chinese & East Indian
20. Chinese & Vietnamese
21. Vietnamese & Spanish
22. German, French & Polish
23. German, Ukrainian & Polish
24. Ukrainian, Polish & Portuguese
25. Polish, Dutch & French
26. Ukrainian, Dutch & Polish
27. Chinese, Lebanese & Italian
28. Chinese, Vietnamese, Portuguese & Italian
29. East Indian, Chinese & Filipino
30. German, Ukrainian, Dutch & Polish
31. Ukrainian, Dutch, Polish & Italian
32. Ukrainian, Italian, Polish & Portuguese
33. Chinese, Lebanese, Italian & Filipino

Source: 1991 Census of Canada



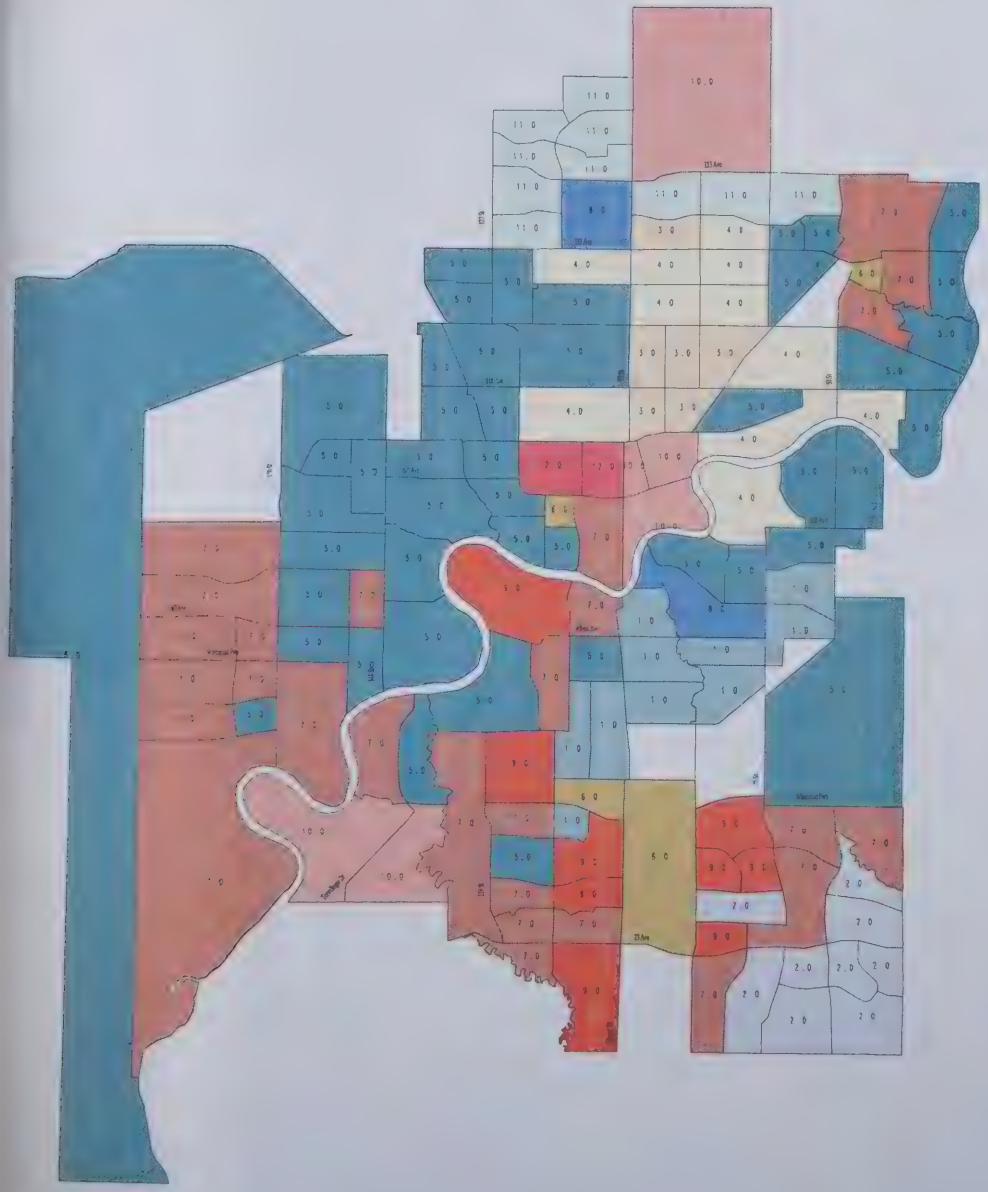
Predominant Ethnic Origins in Edmonton

Key to Cluster Composition

1. Ukrainian, Italian & Dutch
2. Chinese, Ukrainian & Italian
3. Ukrainian & Aboriginal
4. British, German, French, Canadian & Polish
5. British, Ukrainian & German
6. Chinese, Canadian & East Indian
7. British, Canadian, French & Aboriginal
8. British & French
9. Chinese & East Indian
10. Chinese & East Indian
11. East Indian, Canadian & Chinese
12. Chinese, Vietnamese, Aboriginal & Portuguese

note: Predominate Ethnic Origins refers to all single origins greater than the city average and greater than 5% (single origin).

Source: 1991 Census of Canada



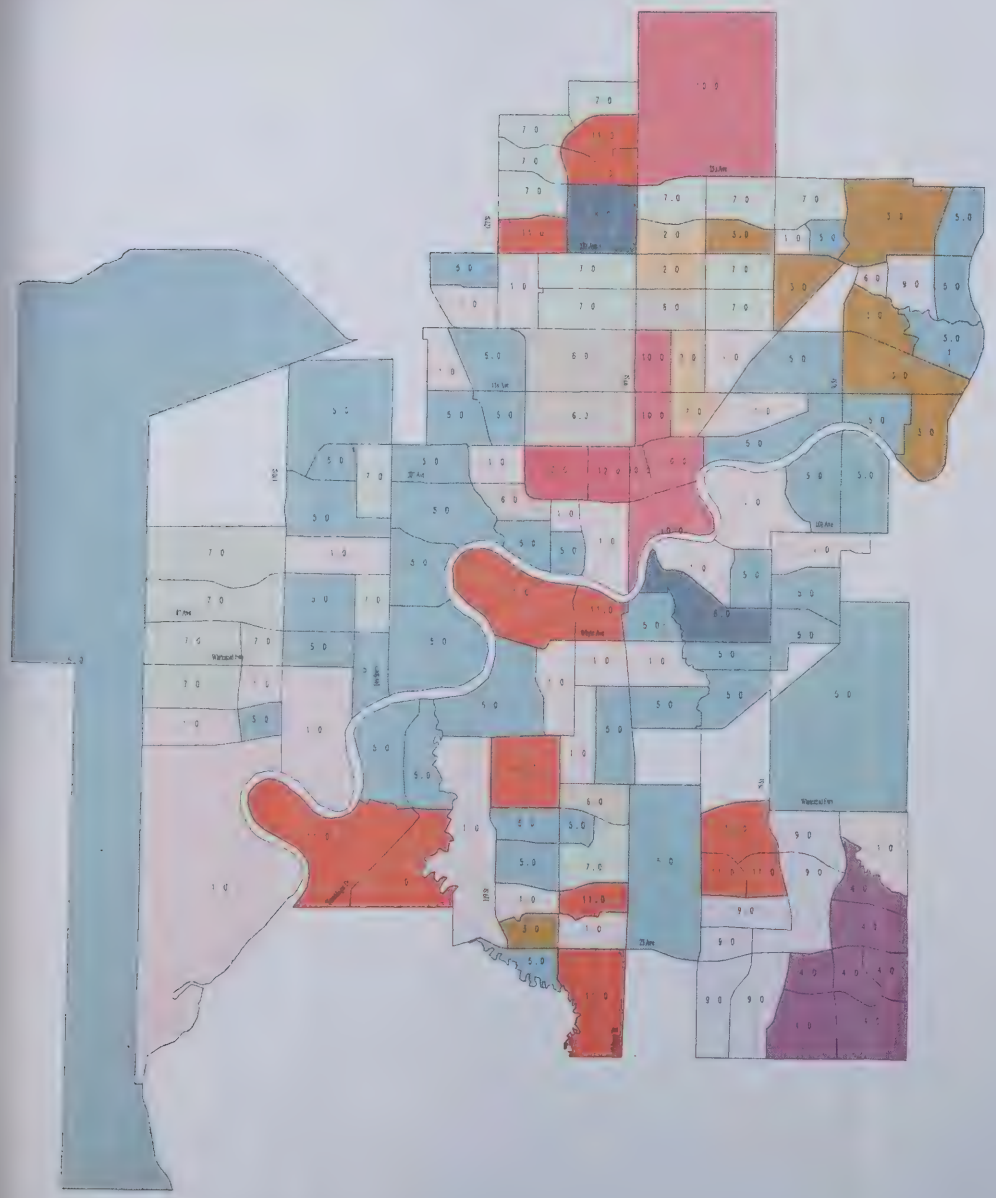
Predominant Mother Tongues in Edmonton

Key to Cluster Composition

1. German, Ukrainian & Polish
2. Punjabi, Spanish & Filipino
3. Chinese, Ukrainian, Portuguese, Italian & Vietnamese
4. Ukrainian, Polish, Portuguese & Italian
5. Ukrainian, German, Dutch & Polish
6. Polish & Spanish
7. Chinese, Russian & Spanish
8. German, Ukrainian, French, Polish, Dutch, Filipino & Italian
9. Chinese & Spanish
10. Chinese & Vietnamese
11. Chinese, Arabic, Italian
12. Vietnamese, Polish & Spanish

note: Predominate Mother Tongues refers to all mother tongues (excluding English) greater than the city average and greater than 5% (non-official language).

Source: 1991 Census of Canada



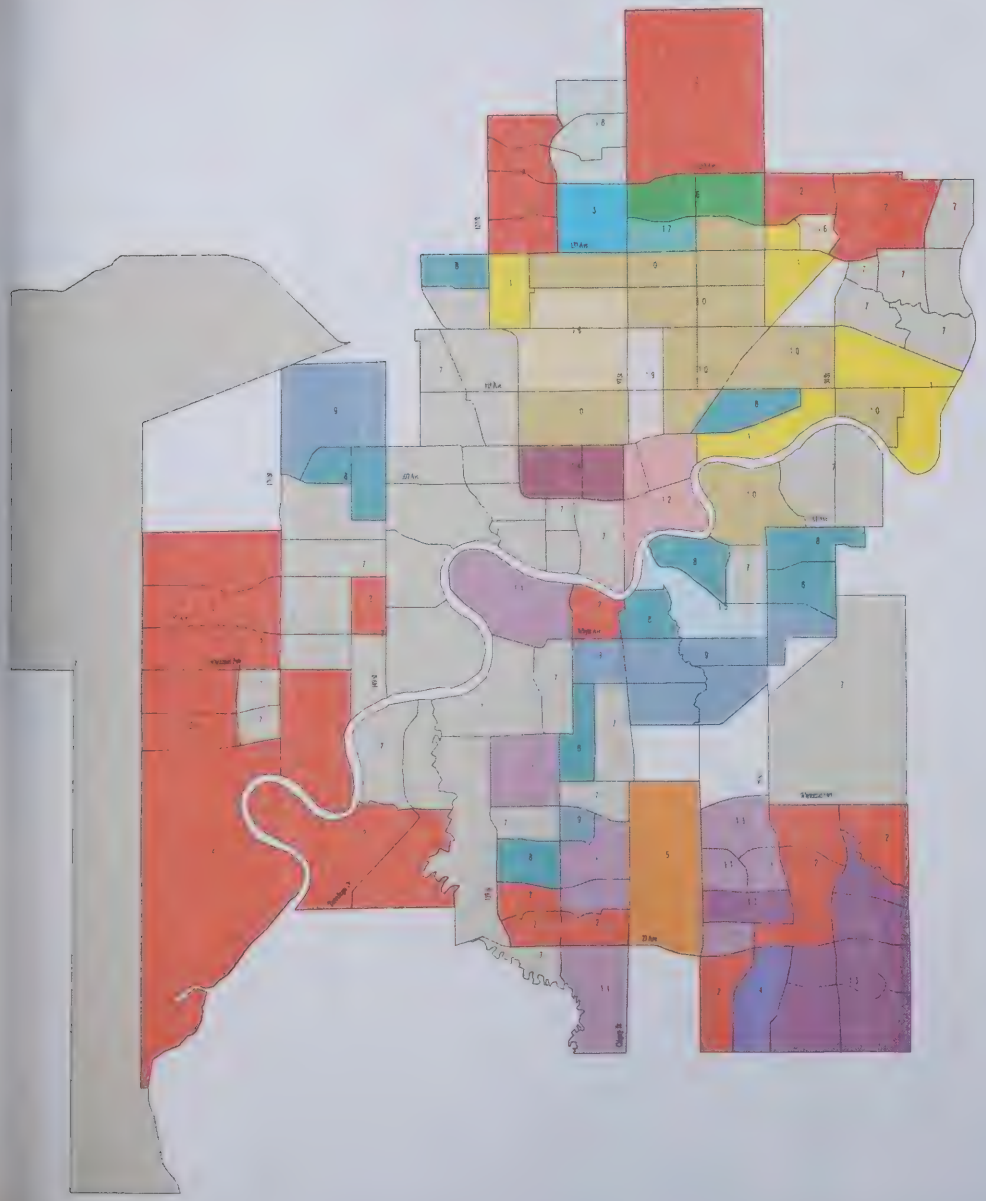
Predominant Home Languages in Edmonton

Key to Cluster Composition

1. Chinese, Polish, Ukrainian & German
2. Italian, Portuguese & Polish
3. Spanish, Polish & Portuguese
4. Punjabi, Hindi & Filipino
5. German, Polish & Ukrainian
6. Polish, Vietnamese, Spanish, Portuguese & Ukrainian
7. Chinese, Arabic & Italian
8. German, French & Filipino
9. Punjabi & Spanish
10. Chinese, Vietnamese & Portuguese
11. Chinese
12. Vietnamese, Khmer & Spanish

note: Predominate Home Languages refers to all home languages (excluding English) greater than the city average and greater than 5% (non-official language).

Source: 1991 Census of Canada



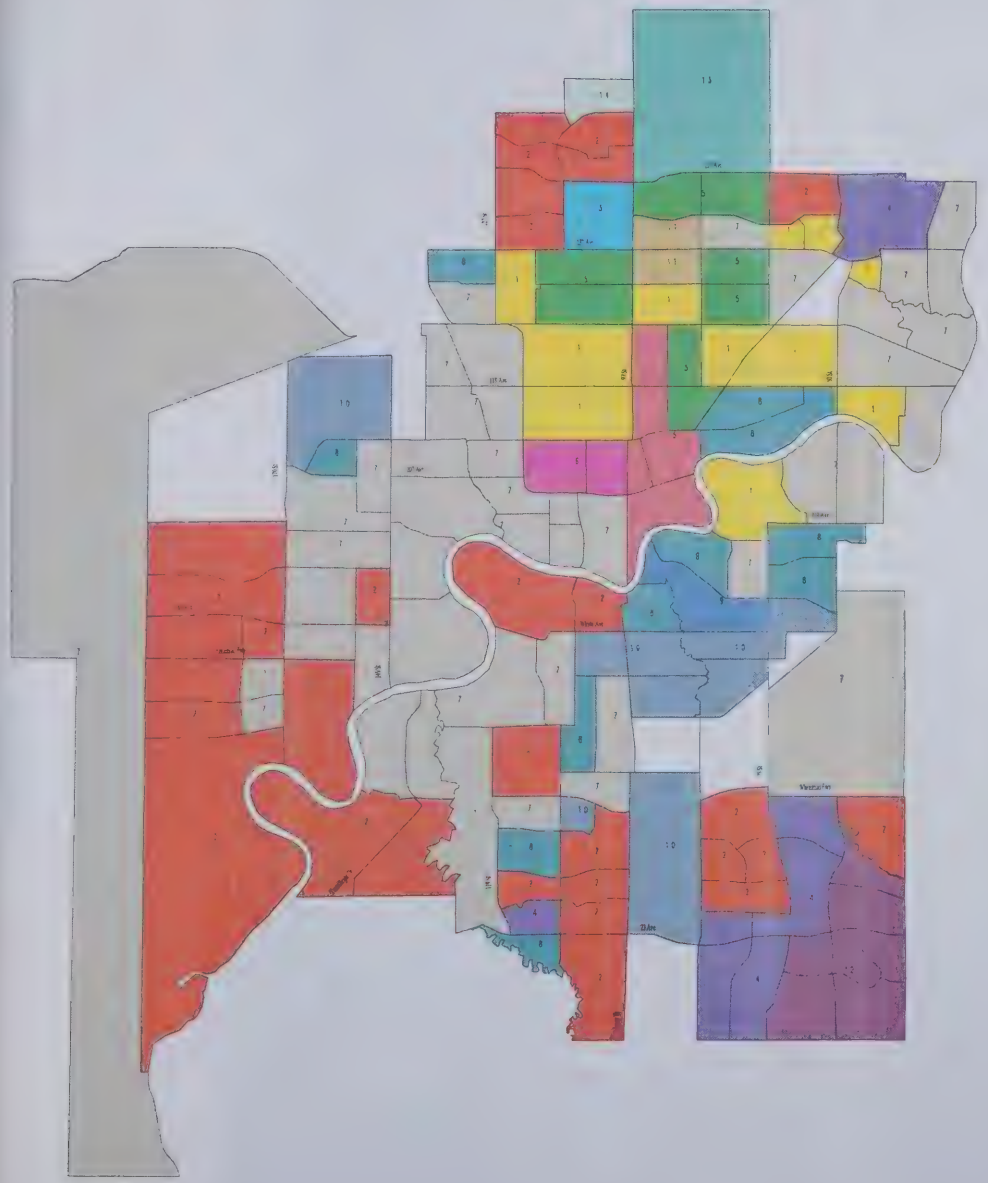
Culturally Cohesive Ethnic Origins & Mother Tongues in Edmonton

Key to Ethnic Origins

1. Ukrainian
2. Chinese
3. French
4. East Indian
5. Polish
6. Italian
7. Lack of Cohesion
8. German & Ukrainian
9. German & Polish
10. Ukrainian & Italian
11. Chinese & East Indian
12. Chinese & Vietnamese
13. East Indian & Filipino
14. Vietnamese & Polish
15. German, French & Polish
16. Ukrainian, Italian & Dutch
17. Chinese, Ukrainian & Italian
18. Chinese, Lebanese & Italian
19. Chinese, Vietnamese, Polish & Portuguese

note: Culturally Cohesive Ethnic Origins & Mother Tongues refers to all ethnic origins who retain their corresponding mother tongues (excluding English) at proportions greater than the city average and greater than 5% (single origin or non-official language).

Source: 1991 Census of Canada



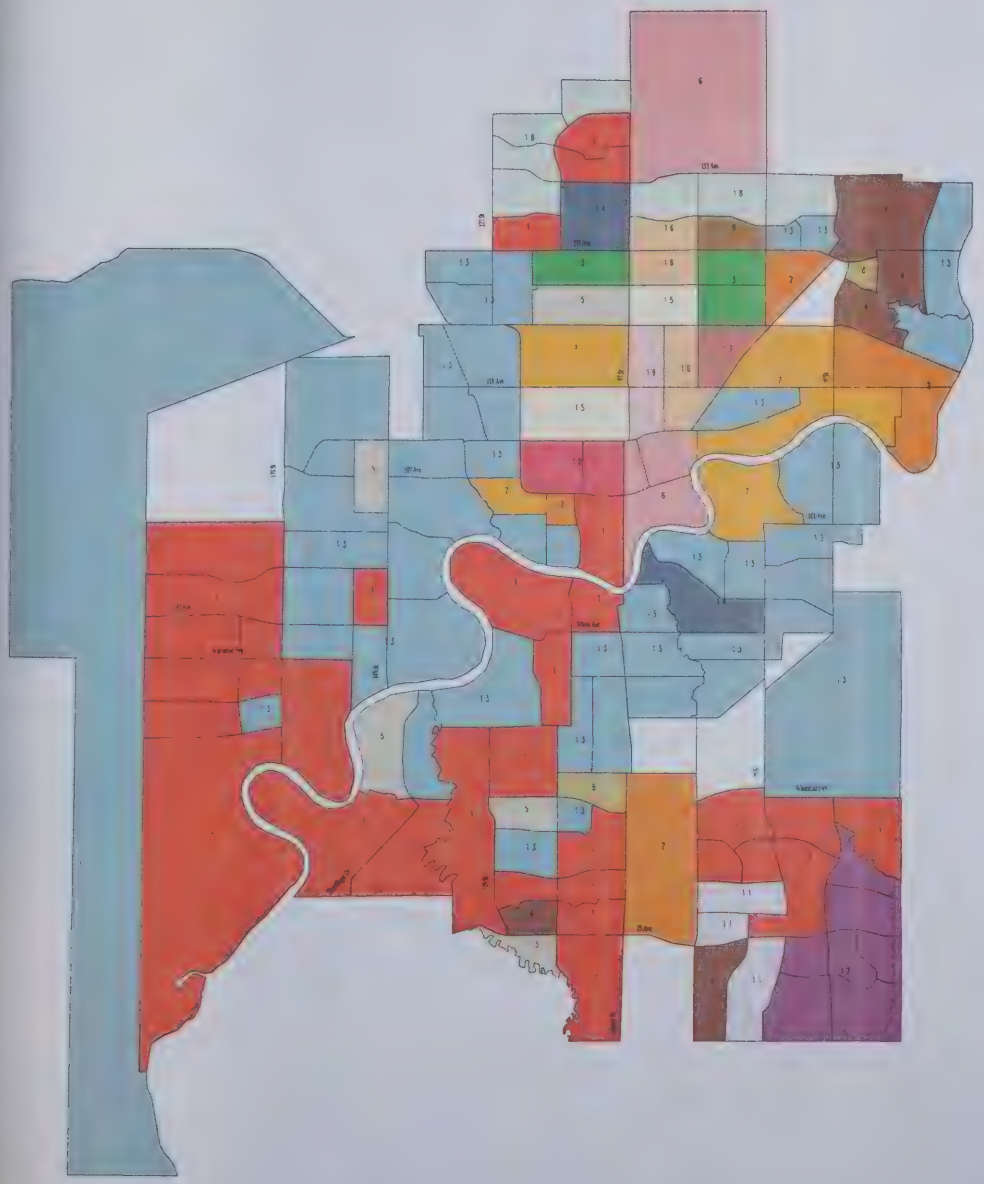
Culturally Cohesive Ethnic Origin & Home Languages in Edmonton

Key to Ethnic Origins

1. Ukrainian
2. Chinese
3. French
4. East Indian
5. Italian
6. Vietnamese
7. Lack of Cohesion
8. German & Ukrainian
9. German & French
10. German & Polish
11. Ukrainian & Italian
12. East Indian & Filipino
13. Chinese, Ukrainian & Italian
14. Chinese, Lebanese & Italian
15. Chinese, Vietnamese & Portuguese

note: Culturally Cohesive Ethnic Origins & Home Languages refers to all ethnic origins who retain their corresponding home languages (excluding English) at proportions greater than the city average and greater than 5% (single origin or non-official language).

Source: 1991 Census of Canada



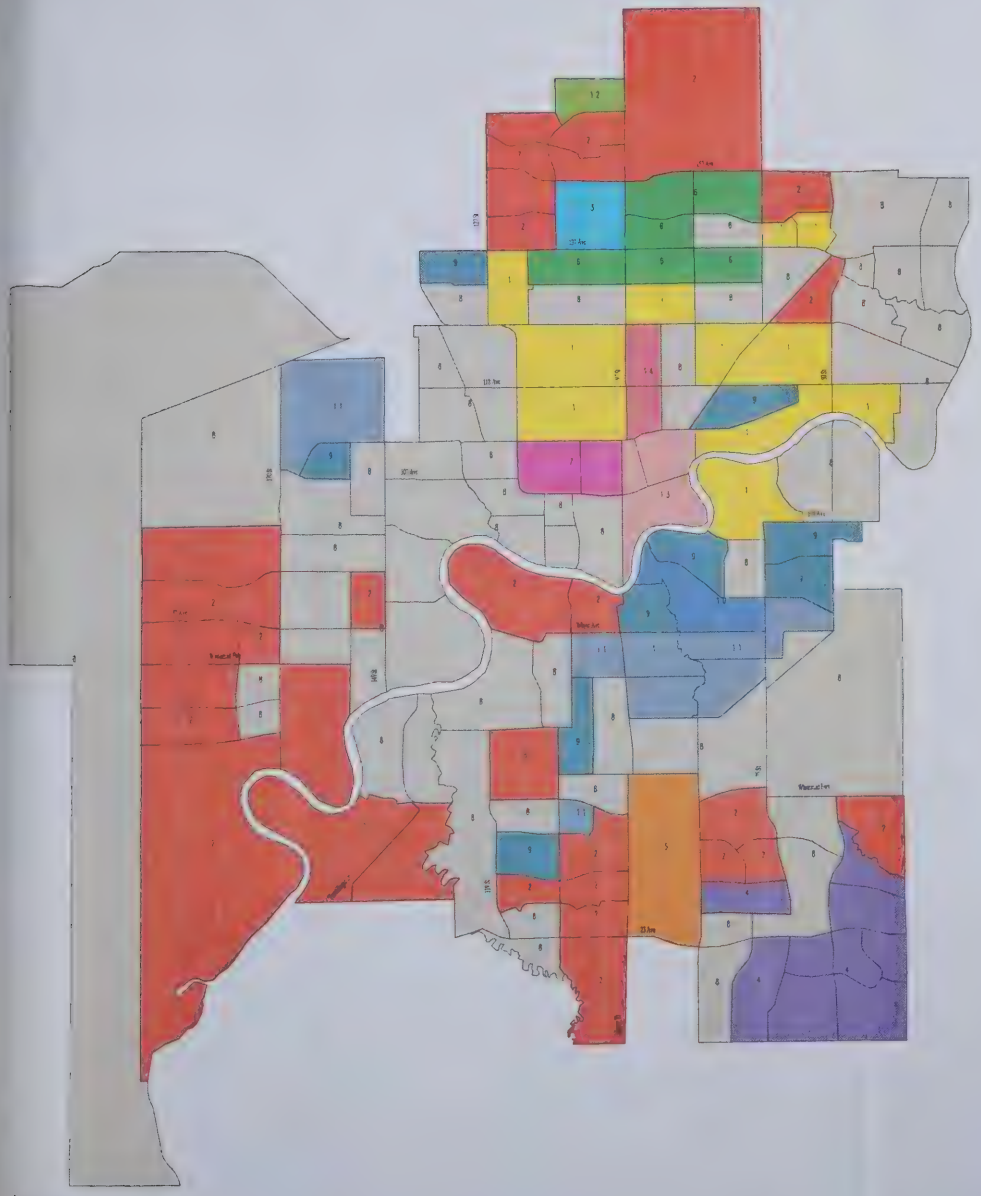
Culturally Cohesive Languages in Edmonton

Key to Ethnic Languages

1. Chinese
2. Polish
3. Italian
4. Spanish
5. Lack of Cohesion
6. Chinese & Vietnamese
7. Ukrainian & Polish
8. Polish & Spanish
9. Polish & Portuguese
10. Vietnamese & Spanish
11. Punjabi & Spanish
12. Punjabi & Filipino
13. German, Ukrainian & Polish
14. German, French & Filipino
15. Ukrainian, Polish & Portuguese
16. Portuguese, Italian & Polish
17. Chinese, Ukrainian & Polish
18. Chinese, Arabic & Italian
19. Chinese, Portuguese, Vietnamese, Italian & Ukrainian

note: Culturally Cohesive Languages are all ethnic languages that retain both their mother tongue and home language (both excluding English) at proportions greater than the city average and greater than 5% (non-official language).

Source: 1991 Census of Canada



Culturally Cohesive Ethnic Groups in Edmonton

Key to Ethnic Origins

1. Ukrainian
2. Chinese
3. French
4. East Indian
5. Polish
6. Italian
7. Vietnamese
8. Lack of Cohesion
9. German & Ukrainian
10. German & French
11. German & Polish
12. Chinese & Italian
13. Chinese & Vietnamese
14. Chinese, Vietnamese & Portuguese

note: Culturally Cohesive Ethnic Groups refers to all ethnic origins who retain their corresponding mother tongues and home languages (both excluding English) at proportions greater than the city average (for each individual group) and greater than 5% (single origin or non-official language).

Source: 1991 Census of Canada

APPENDIX 1

Table 1.1

Single Ethnic Origins, for Edmonton, 1991 Census

1. French	11. Polish	21. Norwegian
2. British	12. Portuguese	22. Japanese
3. German	13. Jewish	23. Yugoslav
4. Canadian	14. Black	24. Korean
5. Italian	15. Filipino	25. Swedish
6. Chinese	16. Greek	26. Croatian
7. Aboriginal	17. Hungarian	27. Danish
8. Ukrainian	18. Vietnamese	28. Finnish
9. Dutch (Netherlands)	19. Spanish	29. Other
10. East Indian	20. Lebanese	

Table 1.2

Mother Tongue, Single Responses, for Edmonton, 1991 Census

1. French	10. Greek	19. Inuktitut
2. Italian	11. Punjabi	20. Montagnais - Naskapi
3. Chinese	12. Arabic	21. Athapaskan
4. German	13. Tagalog (Filipino)	22. Bulgarian
5. Portuguese	14. Hungarian	23. South Slave
6. Polish	15. Cree	24. Chipewyan
7. Ukrainian	16. Vietnamese	25. Dogrib
8. Spanish	17. Russian	26. Kutchin - Gwich'in
9. Dutch	18. Finnish	27. Other

Table 1.3

Home Language, Single Responses, for Edmonton, 1991 Census

1. French	12. Cree	23. Hindi
2. Chinese	13. Tagalog	24. Urdu
3. Italian	14. Ukrainian	25. Japanese
4. Portuguese	15. Persian (Farsi)	26. Russian
5. Spanish	16. Korean	27. Creoles
6. German	17. Hungarian	28. Dutch
7. Polish	18. Tamil	29. Khmer
8. Punjabi	19. Gujarati	30. Ojibway
9. Greek	20. Croatian	31. Romanian
10. Vietnamese	21. Armenian	32. Other
11. Arabic	22. Inuktitut	

APPENDIX 2

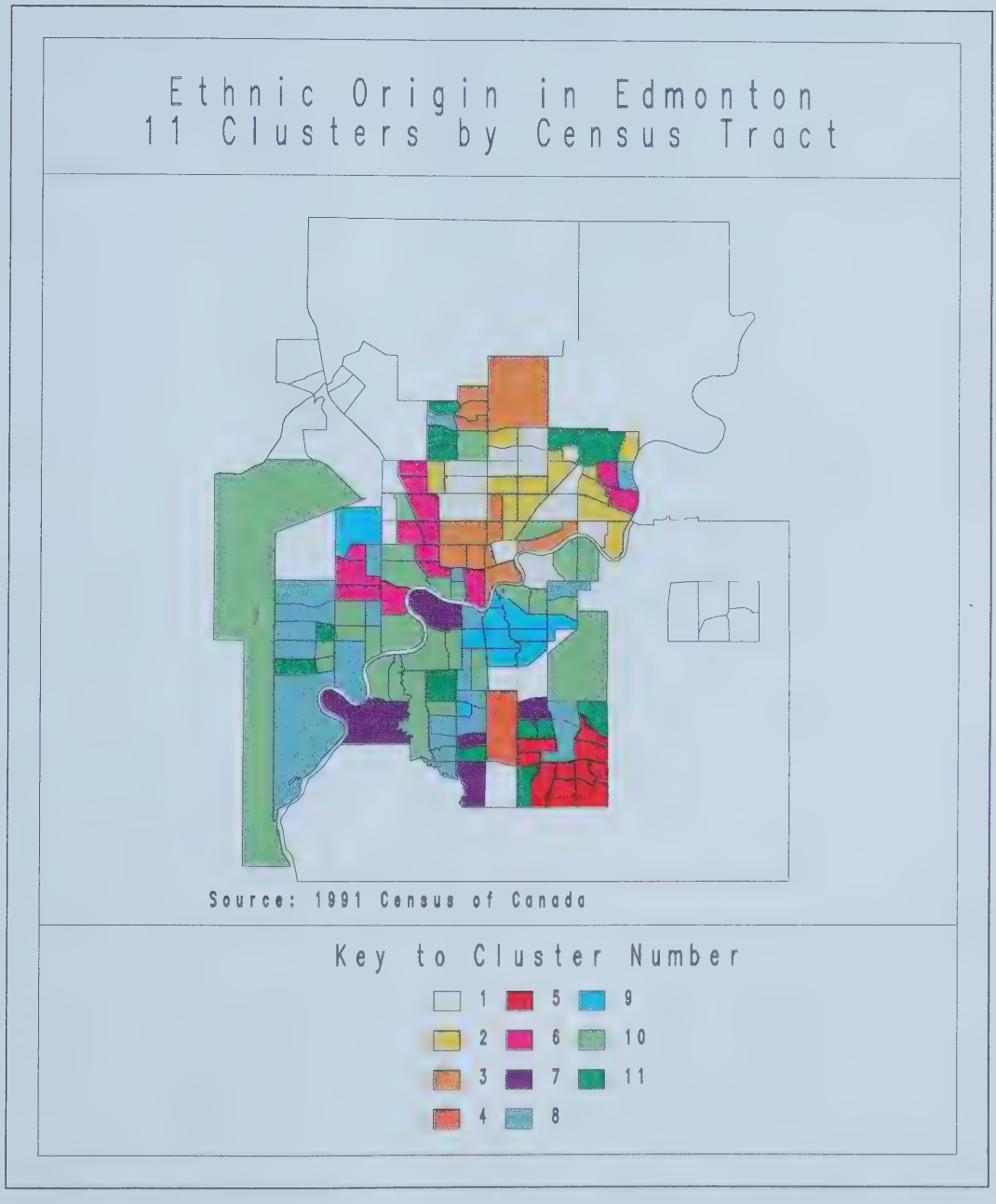


Figure 2.1 Ethnic origin in eleven clusters.

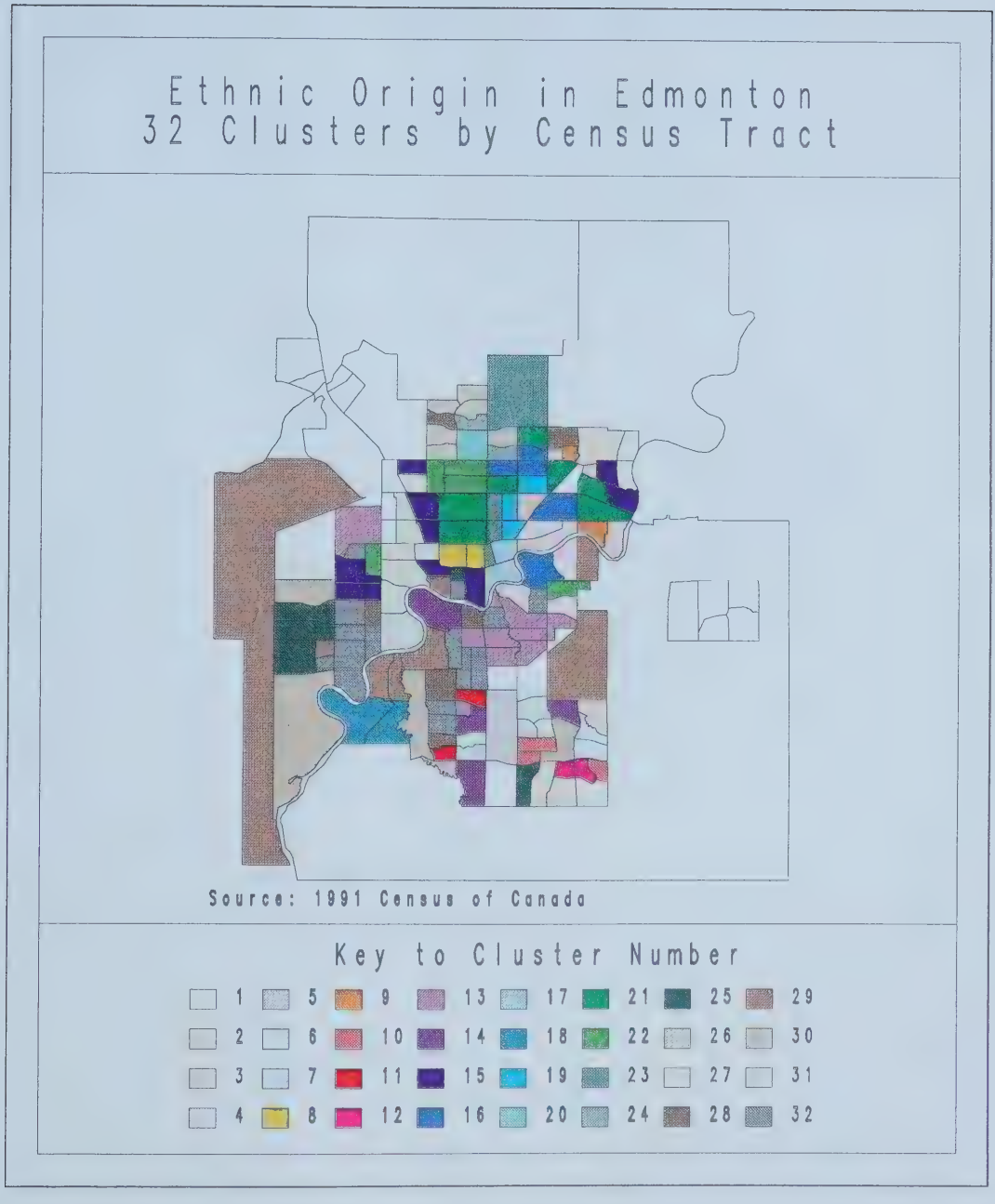


Figure 2.2 Ethnic origin in thirty-two clusters.

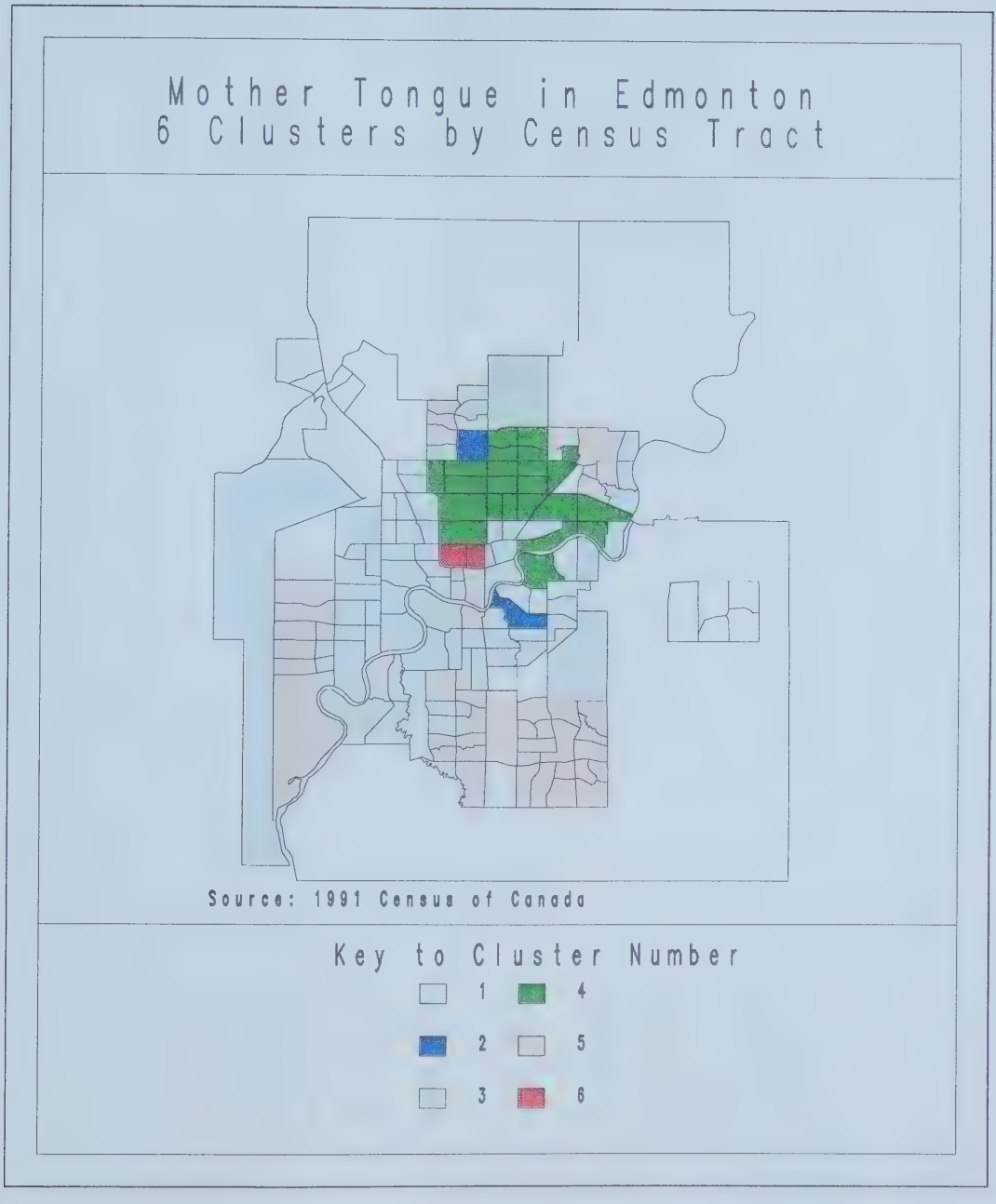


Figure 2.3 Mother tongue in six clusters.

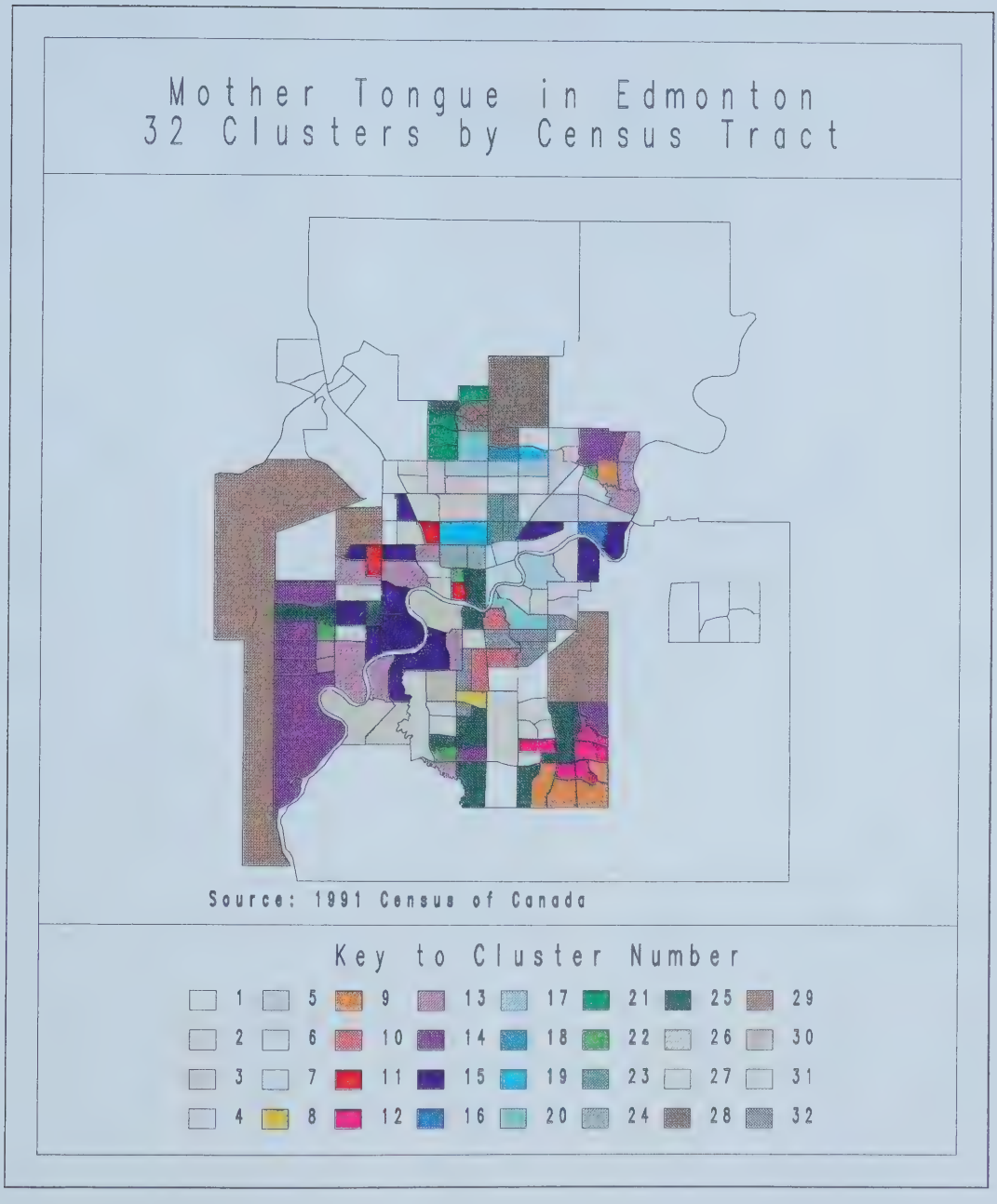


Figure 2.4 Mother tongue in thirty-two clusters.

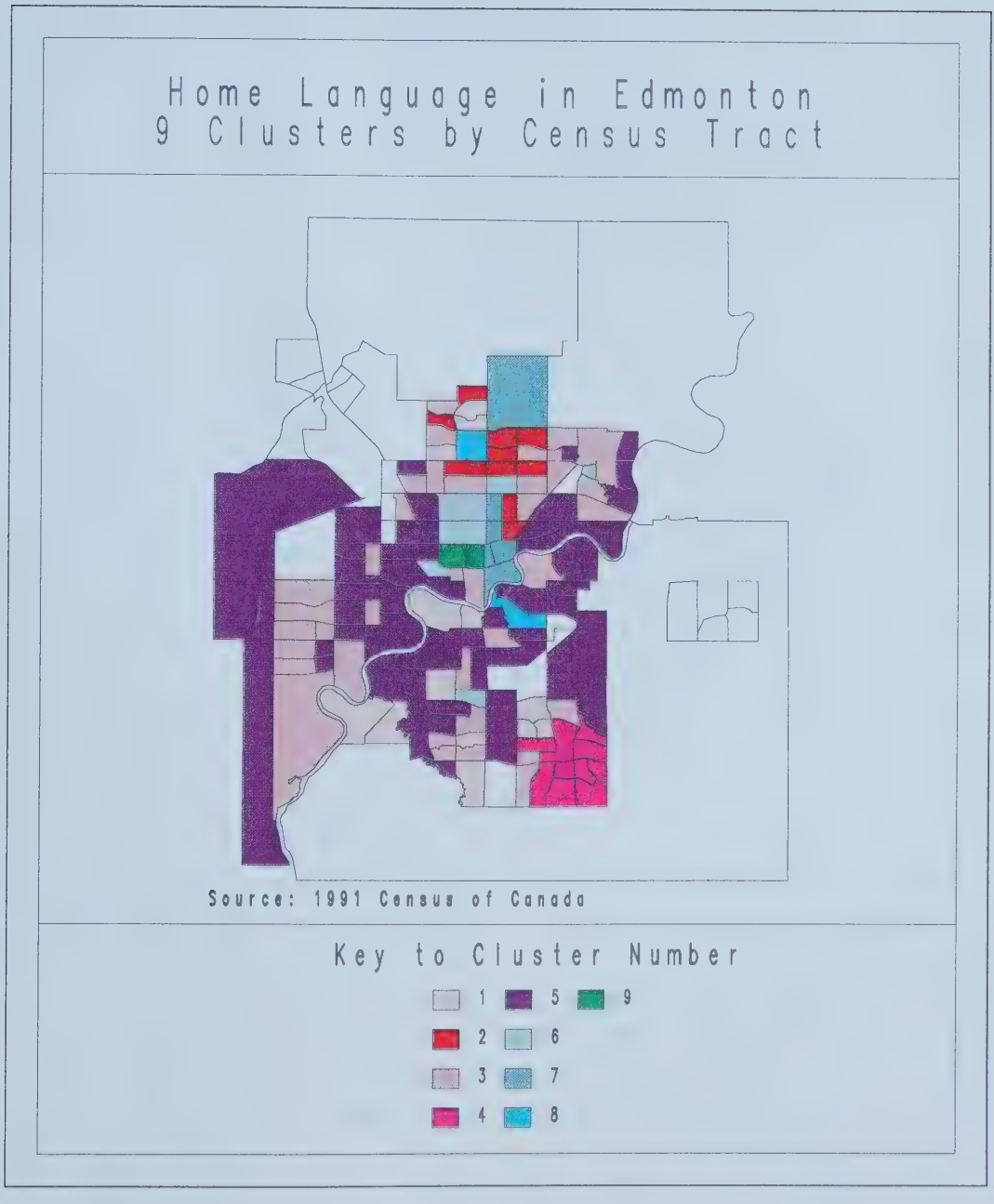


Figure 2.5 Home language in nine clusters.

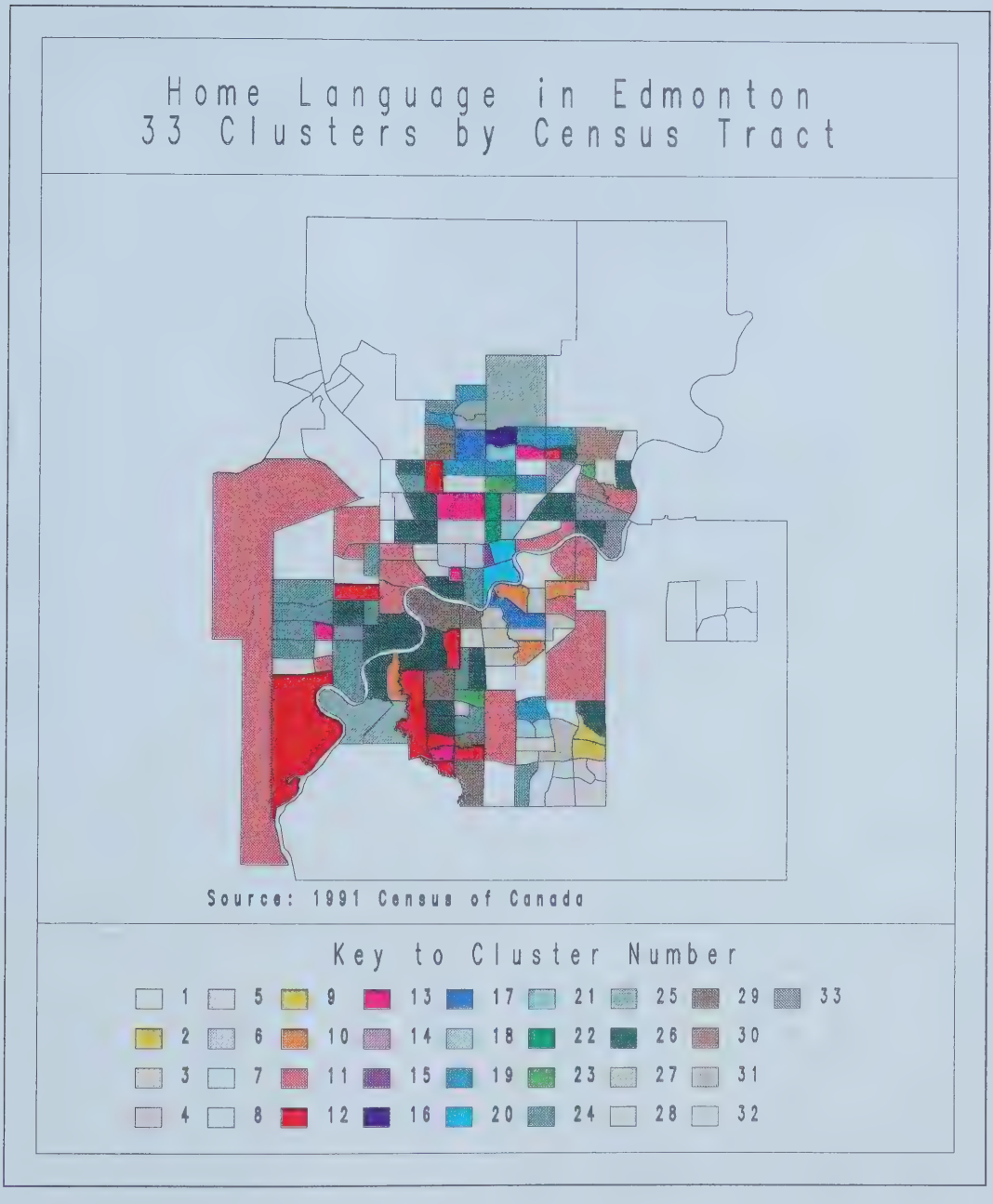


Figure 2.6 Home language in thirty-three clusters.

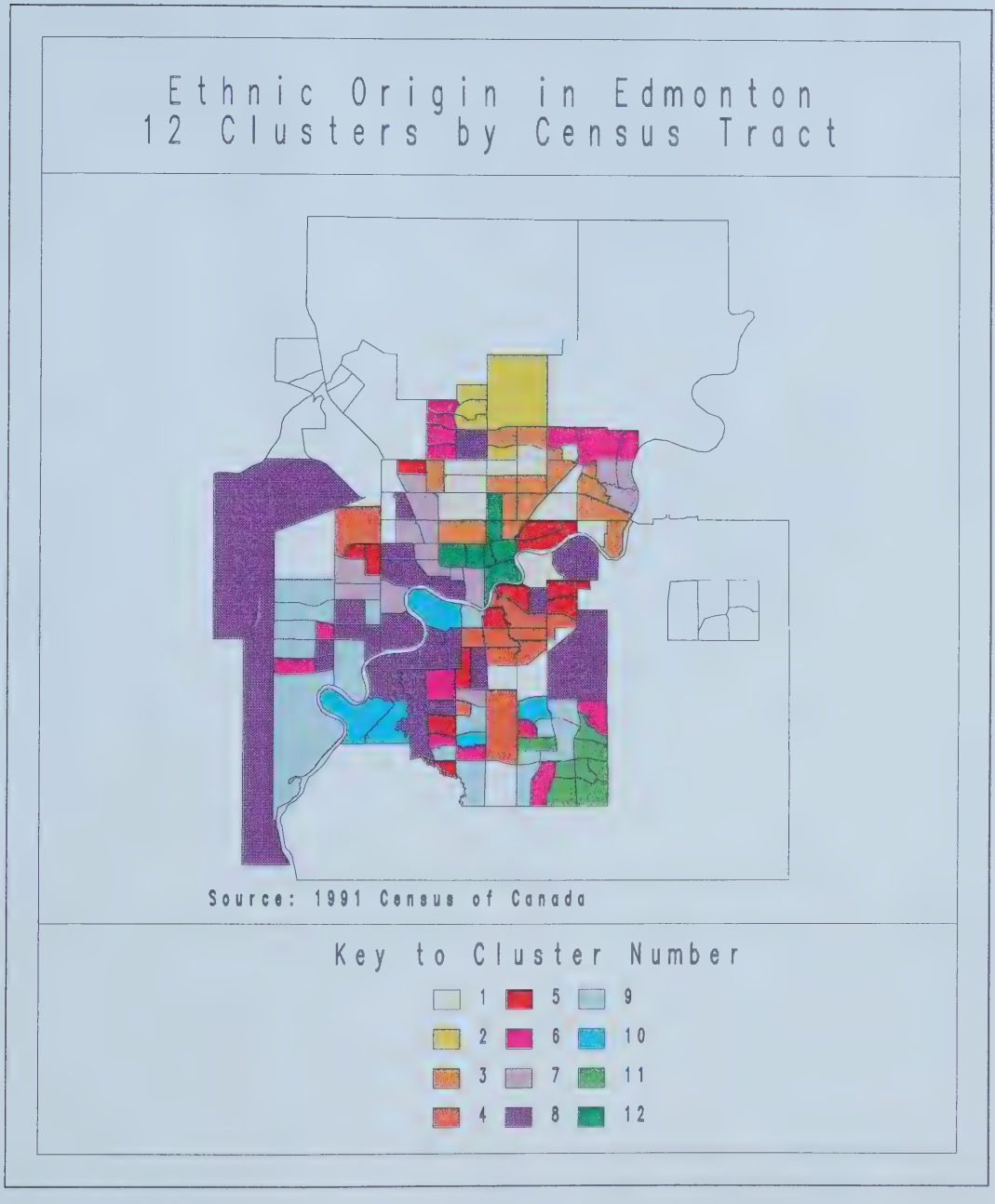


Figure 2.7 Ethnic origin in twelve clusters.

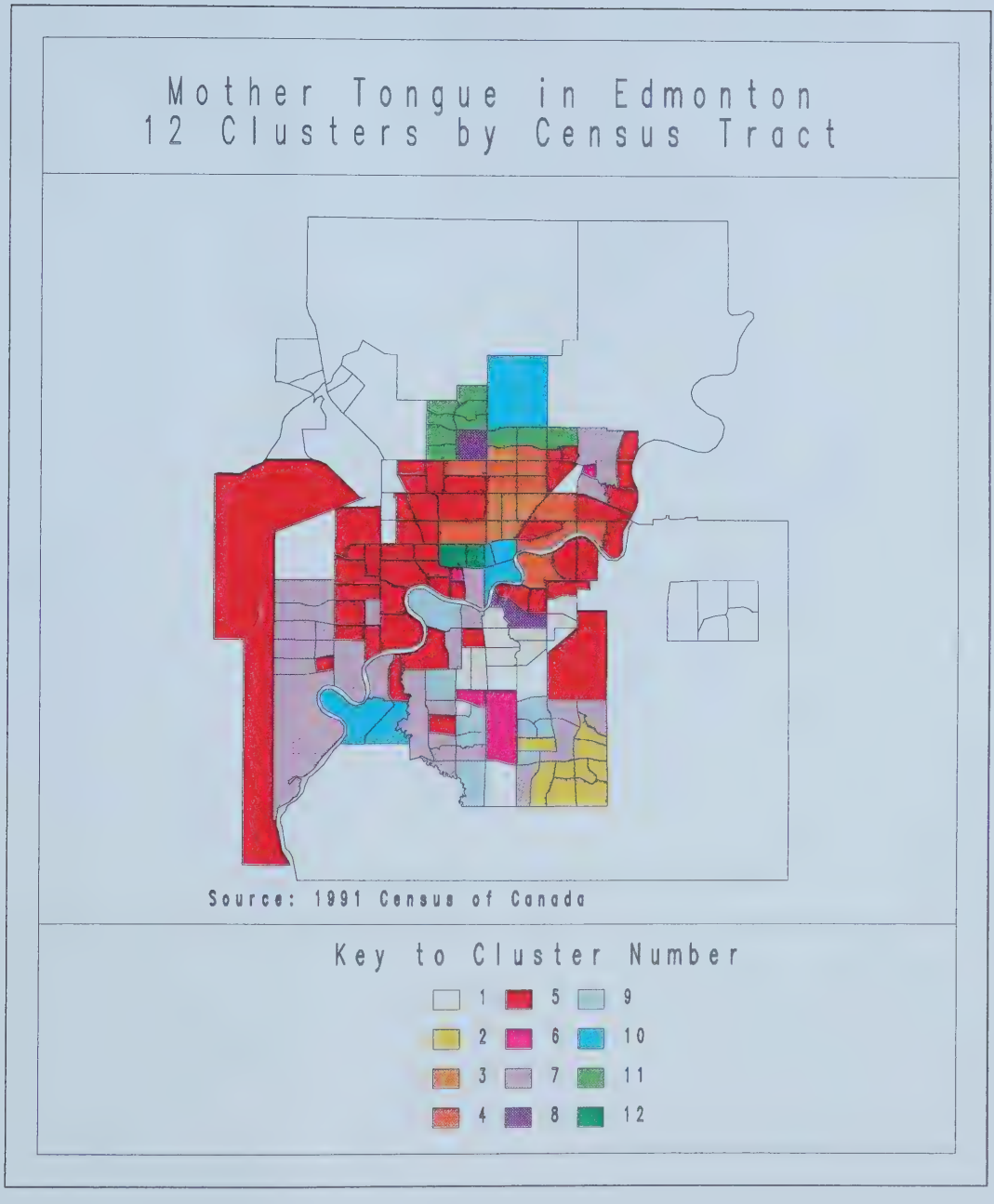


Figure 2.8 Mother tongue in twelve clusters.

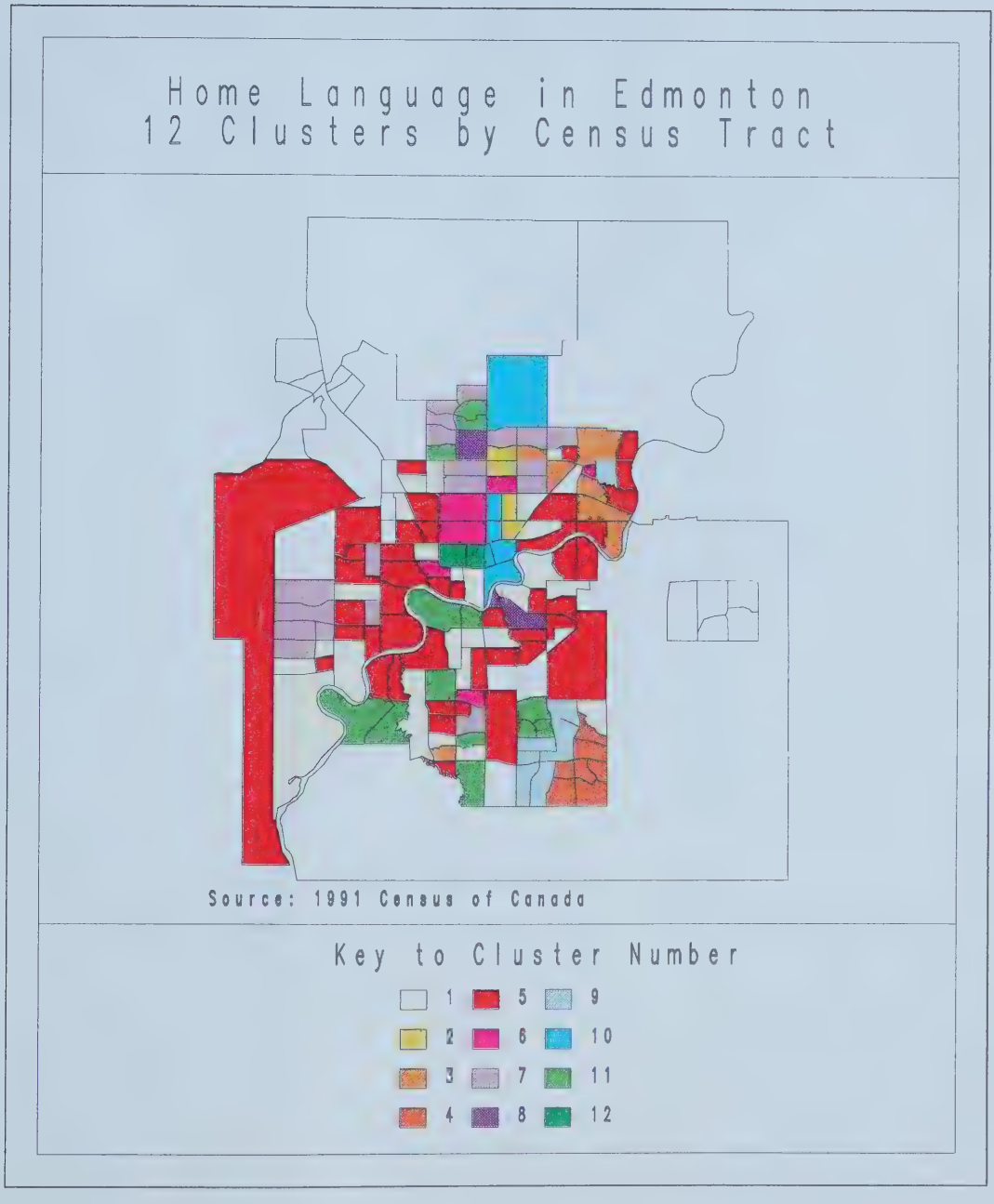


Figure 2.9 Home language in twelve clusters.

APPENDIX 3

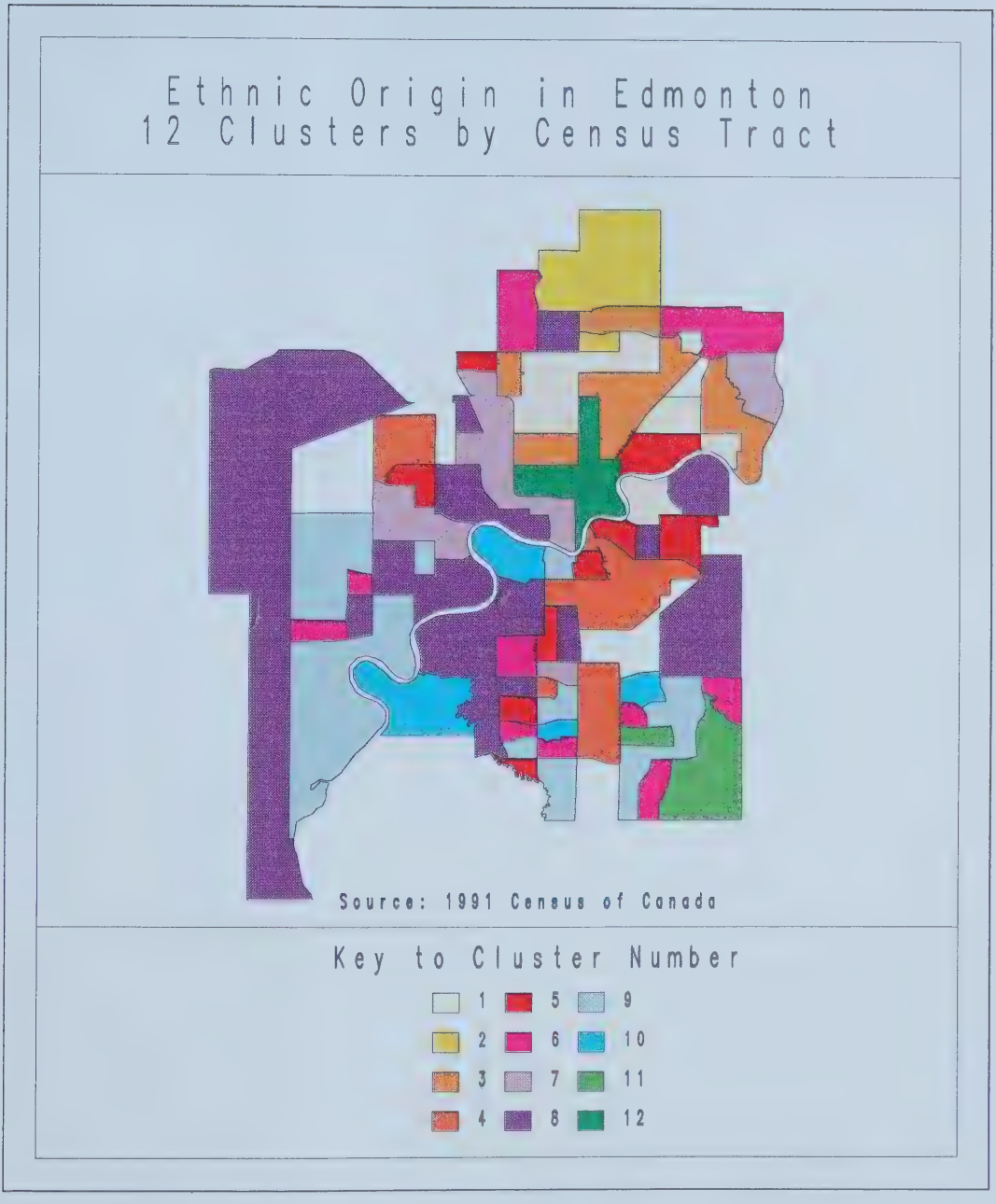


Figure 3.1 Ethnic origin in twelve clusters after dissolve.

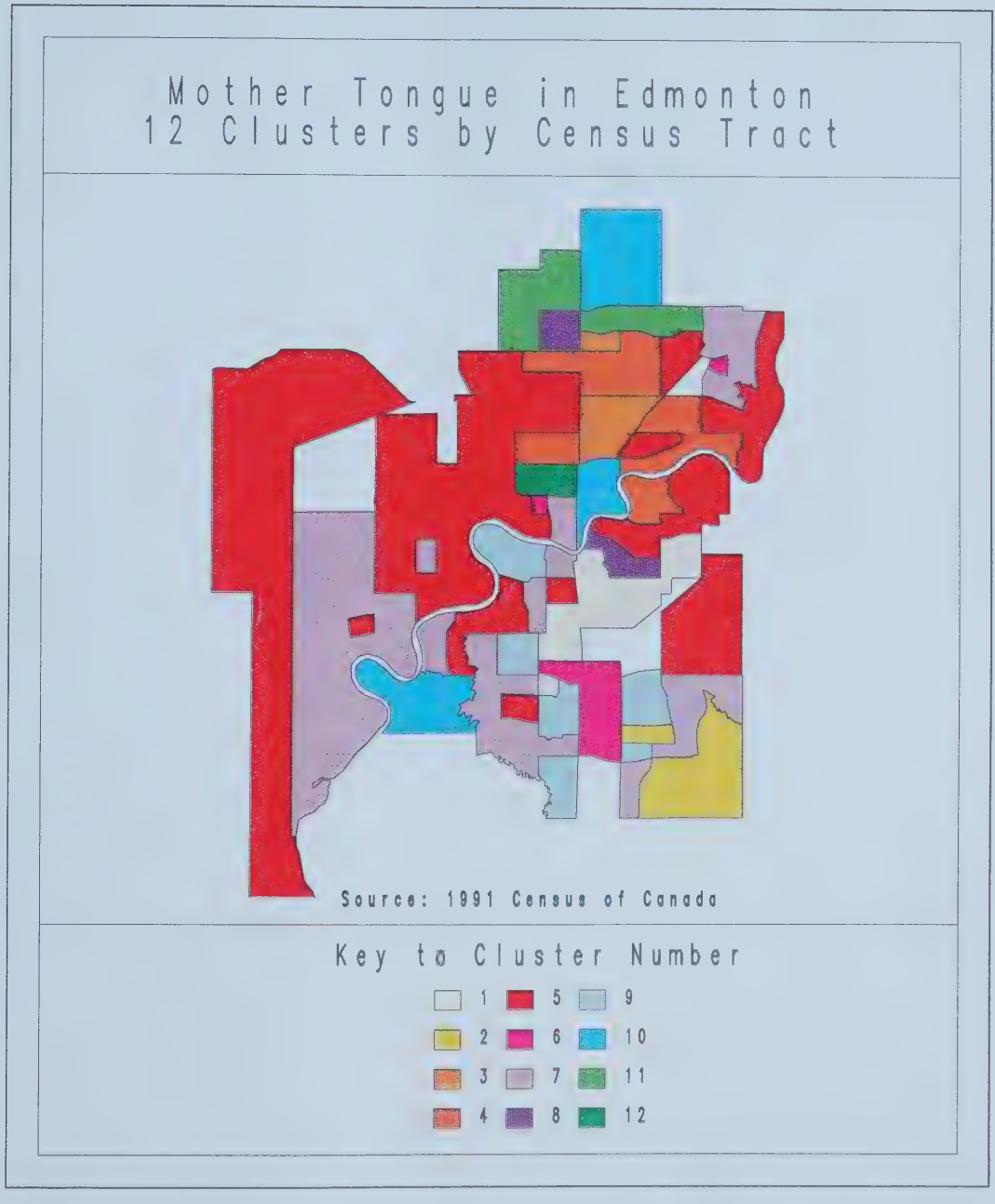


Figure 3.2 Mother tongue in twelve clusters after dissolve.

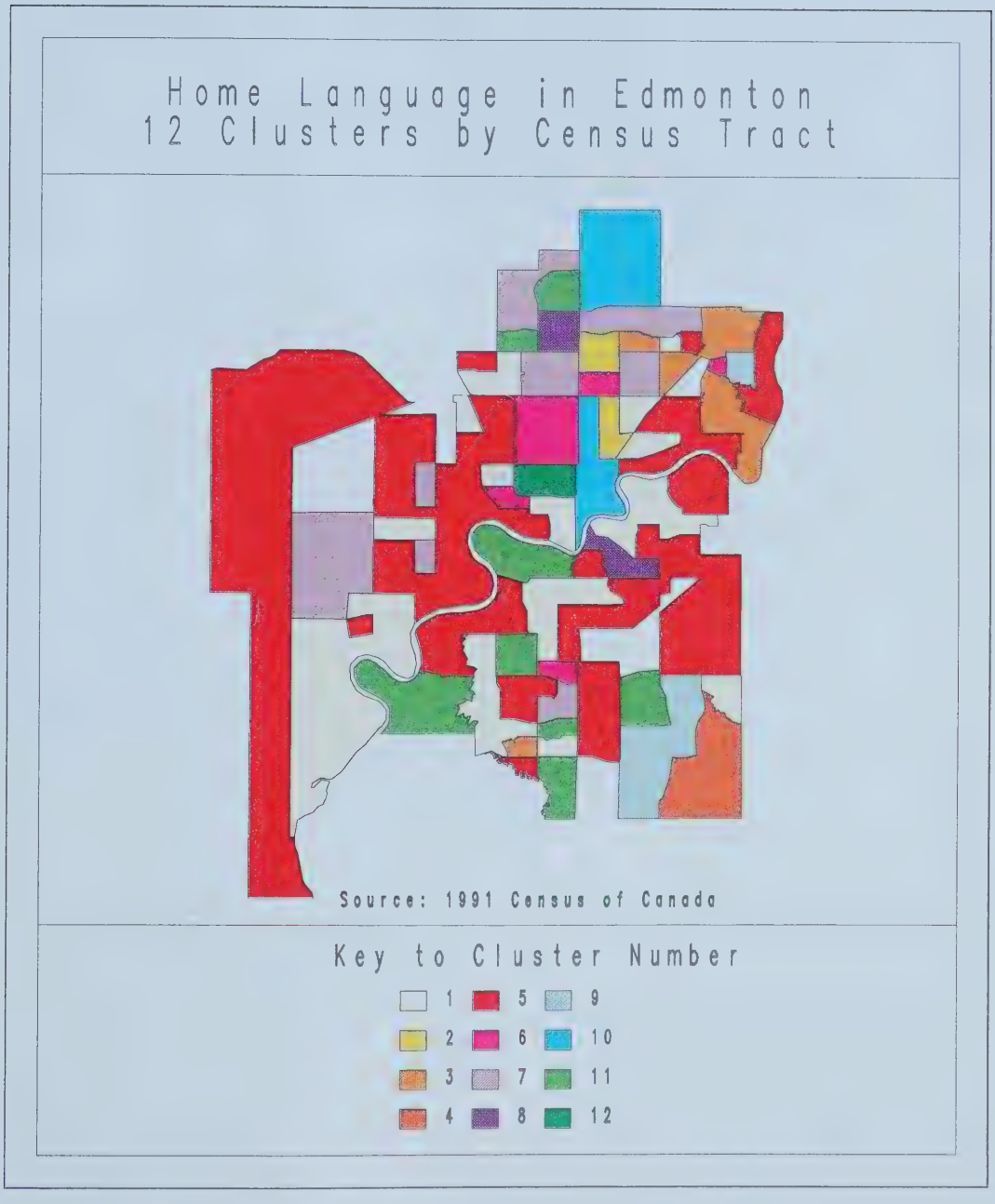
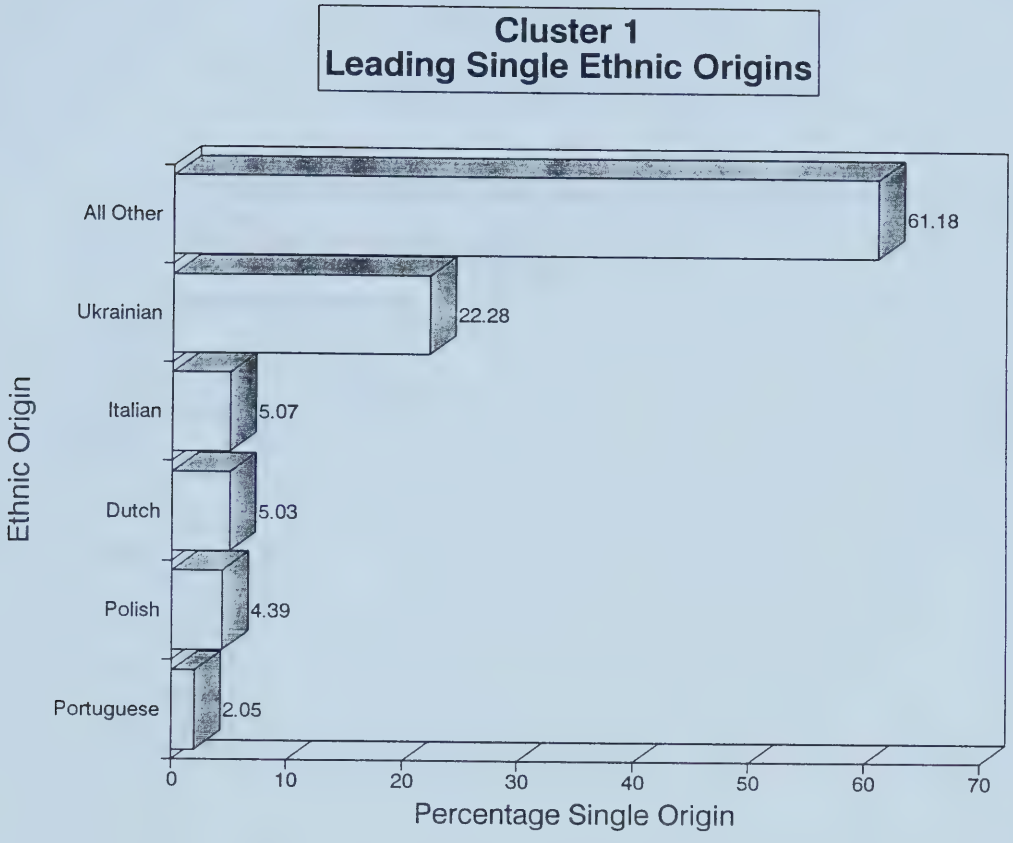
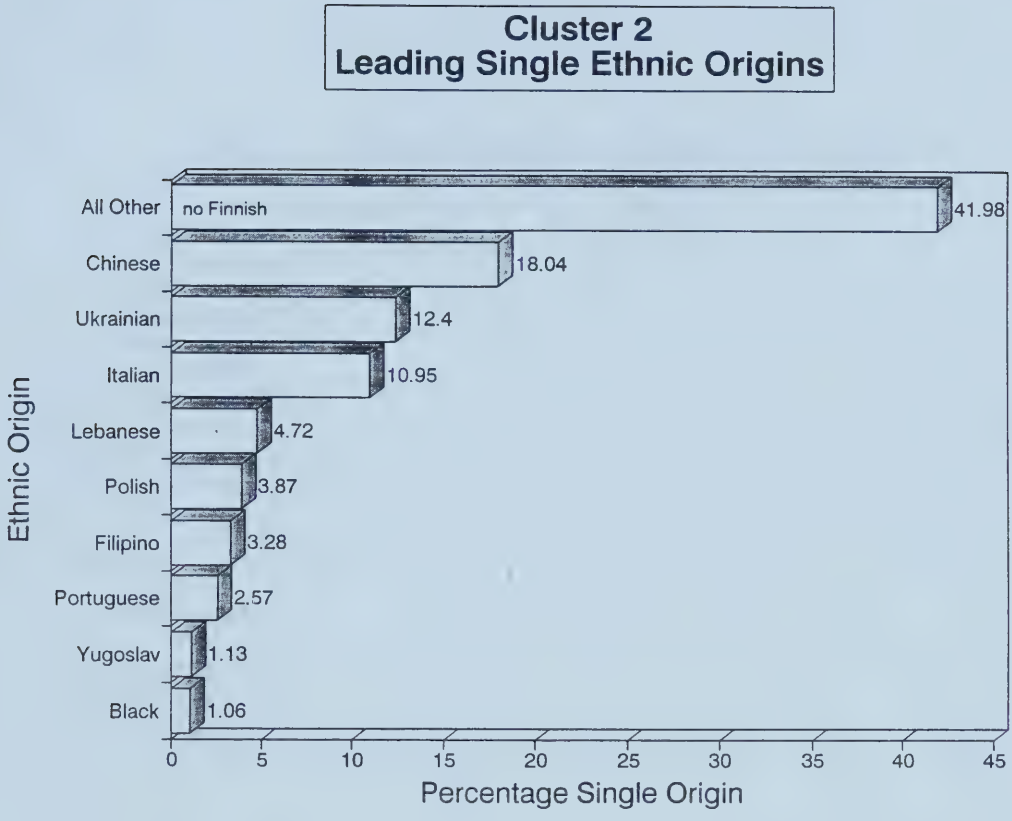
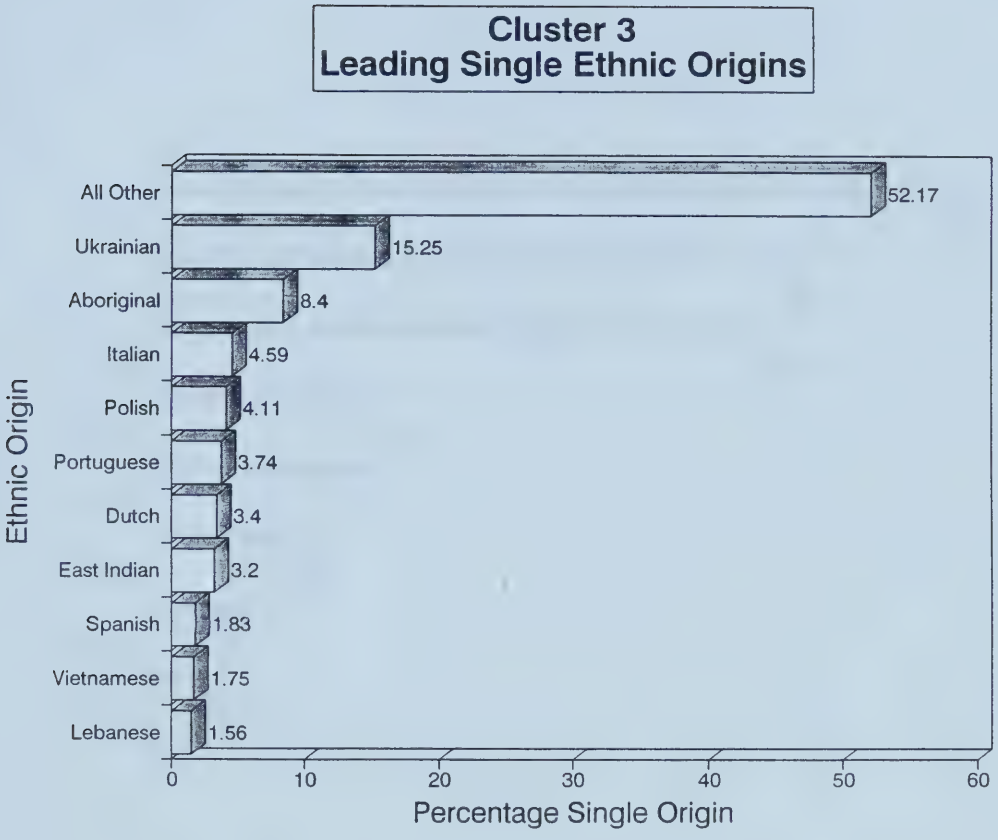


Figure 3.3 Home language in twelve clusters after dissolve.

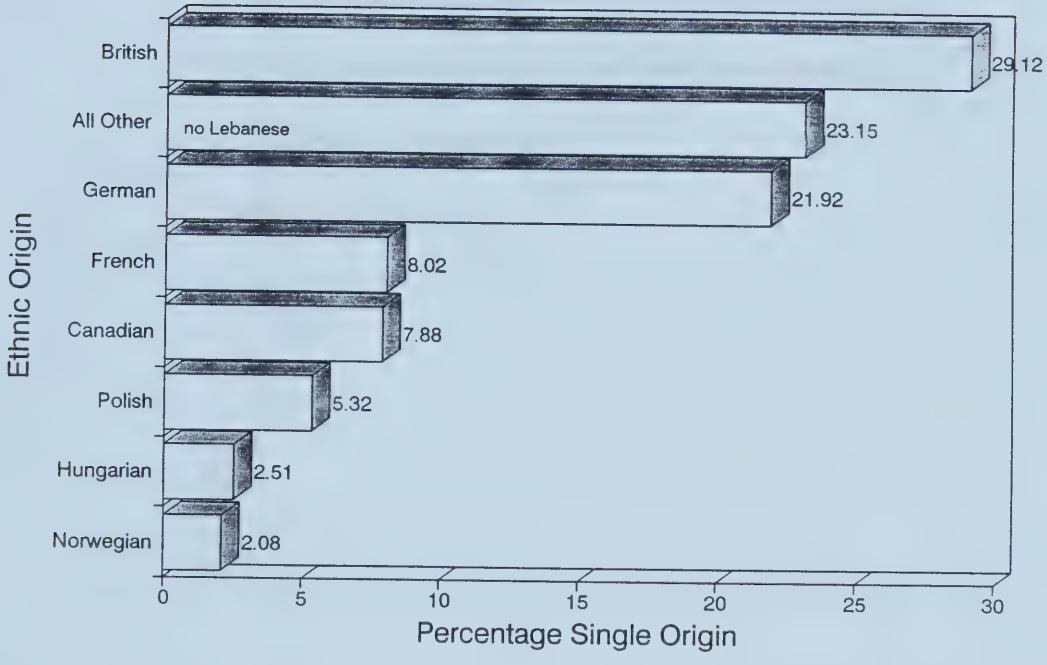
APPENDIX 4

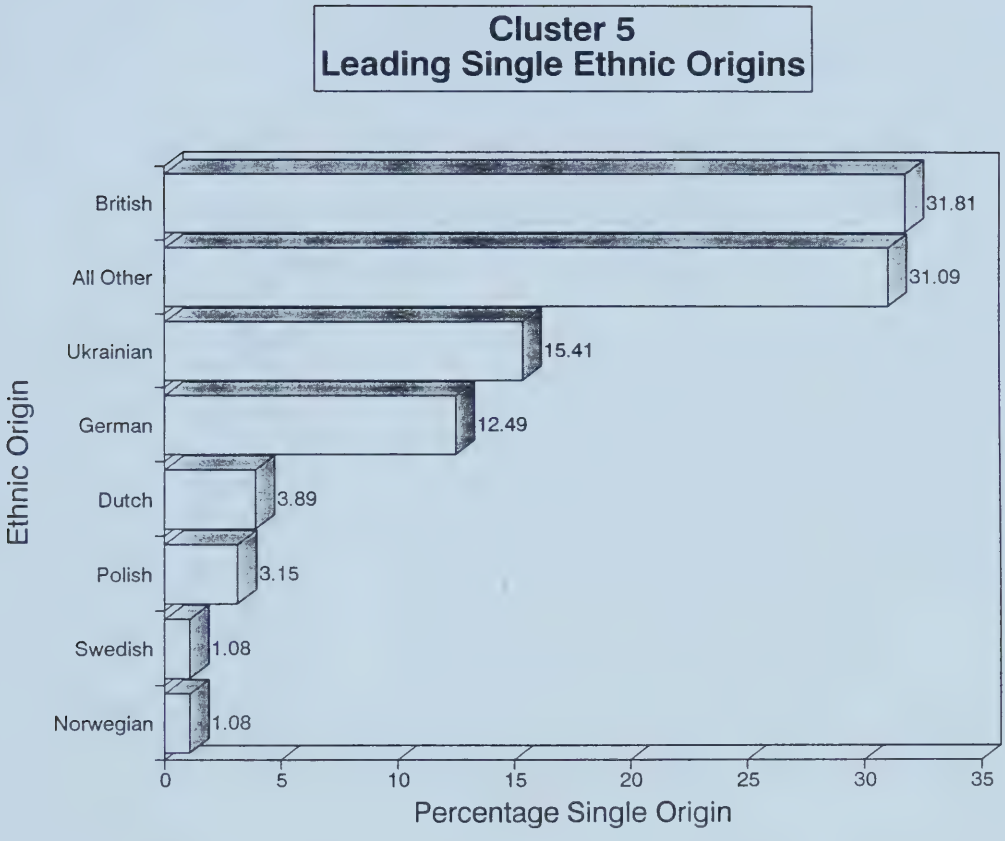

Cluster 1
Leading Single Ethnic Origins
Ethnic Origin
All Other
Ukrainian
Italian
Dutch
Polish
Portuguese
61.18
22.28
5.07
5.03
4.39
2.05
0
10
20
30
40
50
60
70
Percentage Single Origin

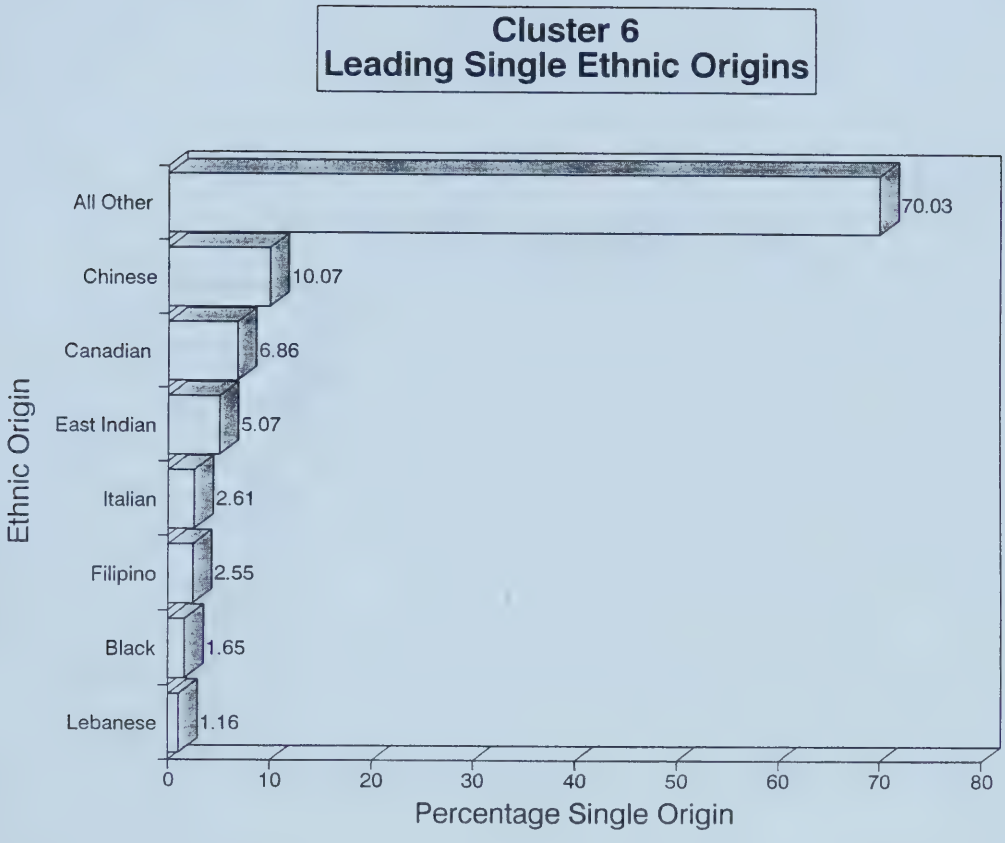

Cluster 2
Leading Single Ethnic Origins
Ethnic Origin
All Other
no Finnish
41.98
Chinese
18.04
Ukrainian
12.4
Italian
10.95
Lebanese
4.72
Polish
3.87
Filipino
3.28
Portuguese
2.57
Yugoslav
1.13
Black
1.06
0
5
10
15
20
25
30
35
40
45
Percentage Single Origin

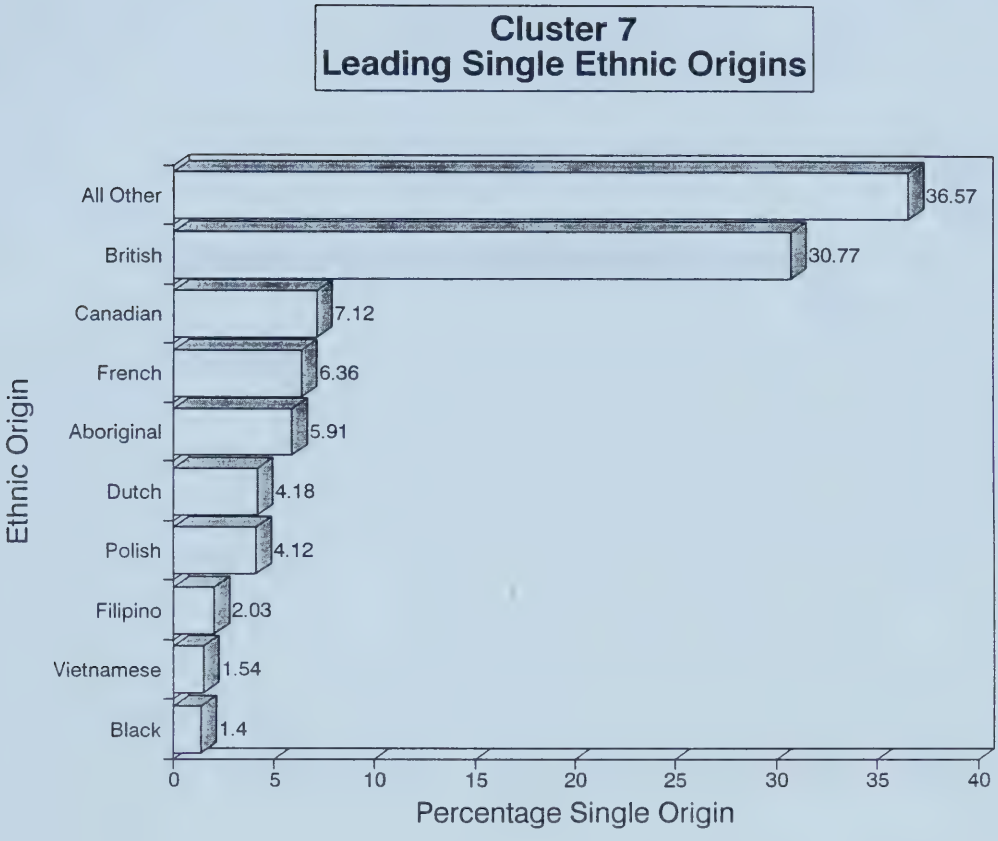

Cluster 3
Leading Single Ethnic Origins
Ethnic Origin
All Other
Ukrainian
Aboriginal
Italian
Polish
Portuguese
Dutch
East Indian
Spanish
Vietnamese
Lebanese
52.17
15.25
8.4
4.59
4.11
3.74
3.4
3.2
1.83
1.75
1.56
0
10
20
30
40
50
60
Percentage Single Origin

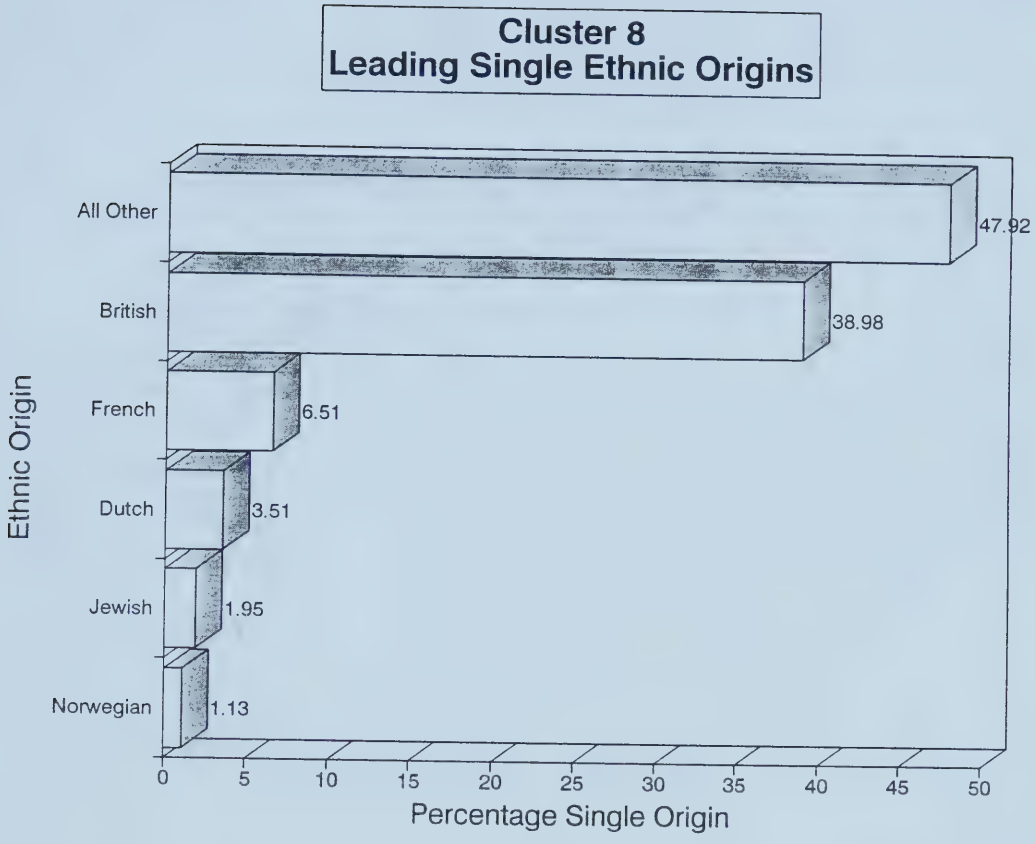
Cluster 4
Leading Single Ethnic Origins

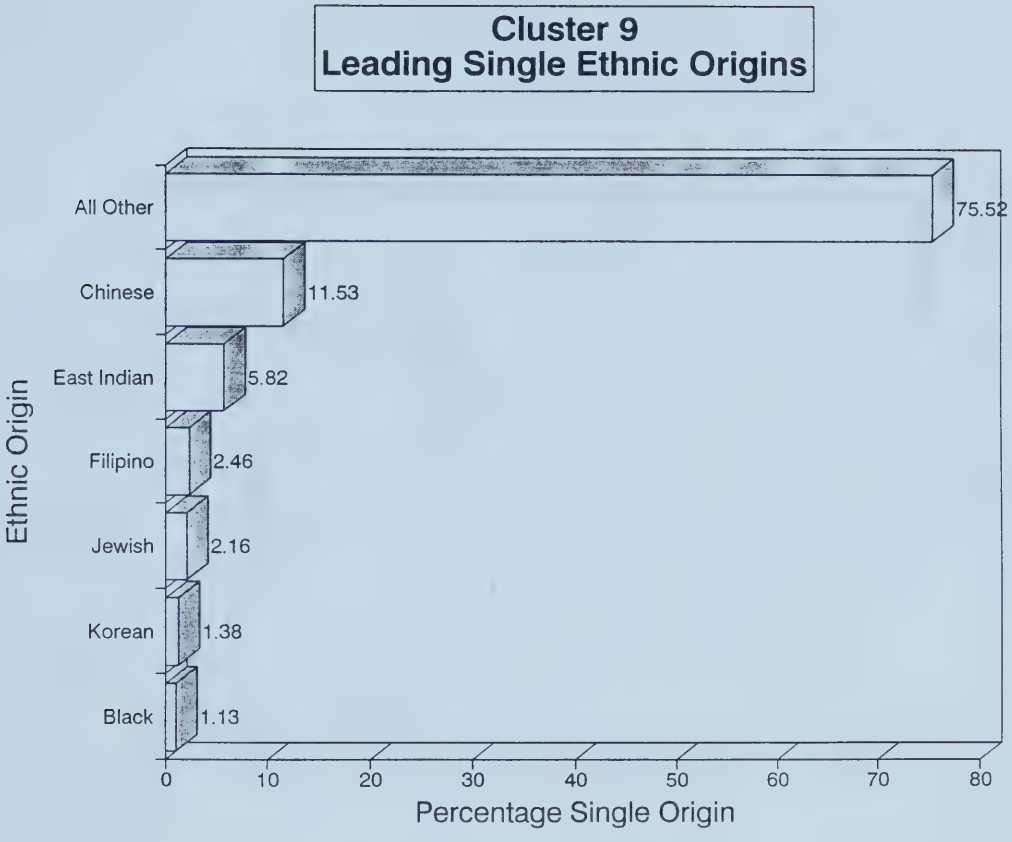



Cluster 5
Leading Single Ethnic Origins
British
All Other
Ukrainian
German
Dutch
Polish
Swedish
Norwegian
31.81
31.09
15.41
12.49
3.89
3.15
1.08
1.08
Ethnic Origin
0
5
10
15
20
25
30
35
Percentage Single Origin

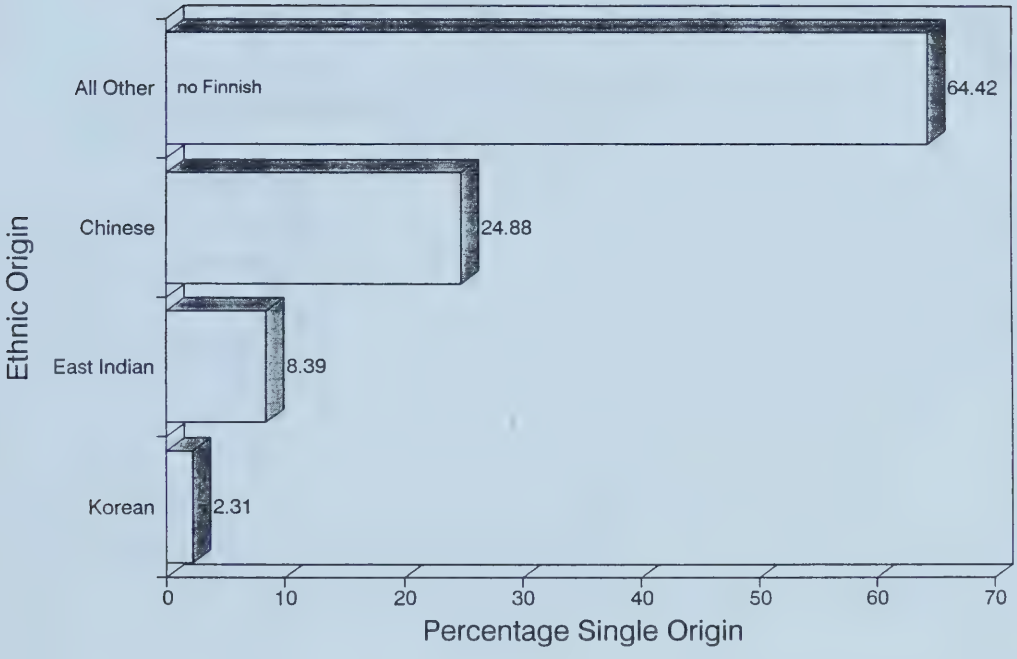

Cluster 6
Leading Single Ethnic Origins
Ethnic Origin
All Other
Chinese
Canadian
East Indian
Italian
Filipino
Black
Lebanese
70.03
10.07
6.86
5.07
2.61
2.55
1.65
1.16
0
10
20
30
40
50
60
70
80
Percentage Single Origin

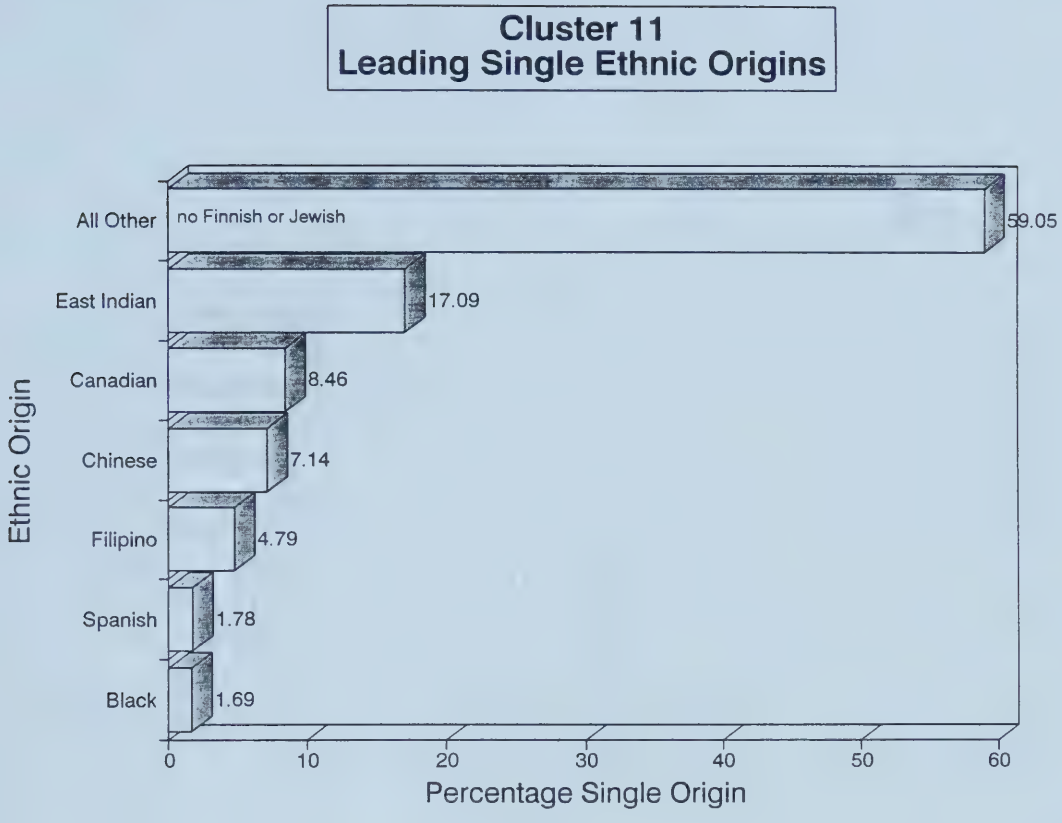

Cluster 7
Leading Single Ethnic Origins
Ethnic Origin
All Other
British
Canadian
French
Aboriginal
Dutch
Polish
Filipino
Vietnamese
Black
36.57
30.77
7.12
6.36
5.91
4.18
4.12
2.03
1.54
1.4
0
5
10
15
20
25
30
35
40
Percentage Single Origin

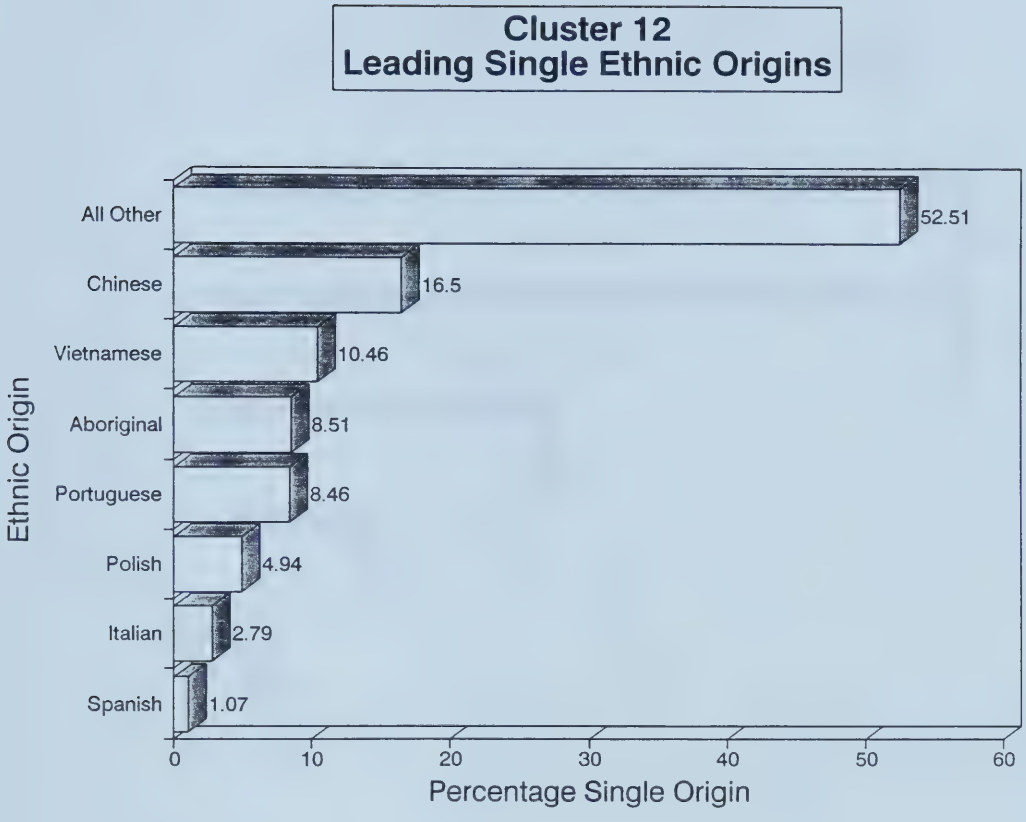

Cluster 8
Leading Single Ethnic Origins
All Other
British
French
Dutch
Jewish
Norwegian
47.92
38.98
6.51
3.51
1.95
1.13
Ethnic Origin
0
5
10
15
20
25
30
35
40
45
50
Percentage Single Origin


Cluster 9
Leading Single Ethnic Origins
All Other
Chinese
East Indian
Filipino
Jewish
Korean
Black
75.52
11.53
5.82
2.46
2.16
1.38
1.13
Ethnic Origin
0
10
20
30
40
50
60
70
80
Percentage Single Origin

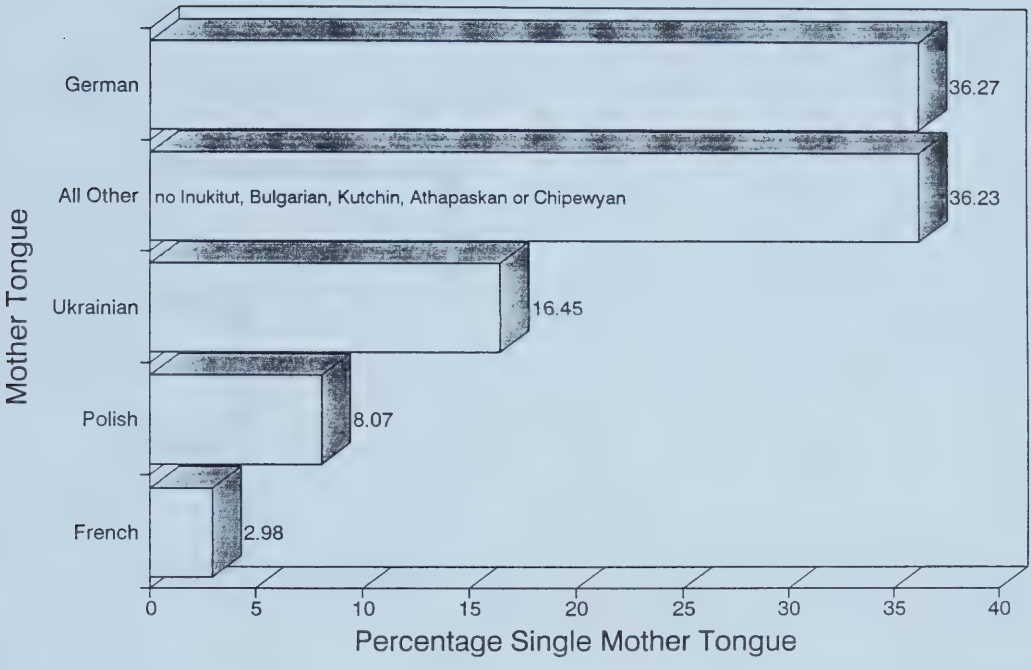
Cluster 10
Leading Single Ethnic Origins



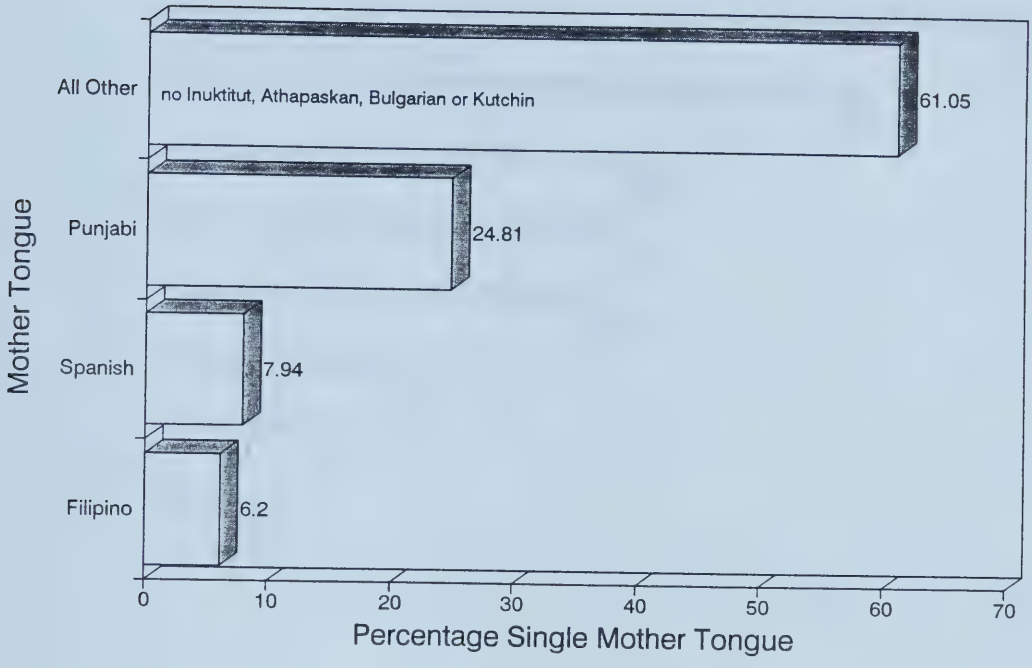

Cluster 11
Leading Single Ethnic Origins
Ethnic Origin
All Other
no Finnish or Jewish
59.05
East Indian
17.09
Canadian
8.46
Chinese
7.14
Filipino
4.79
Spanish
1.78
Black
1.69
0
10
20
30
40
50
60
Percentage Single Origin


Cluster 12
Leading Single Ethnic Origins
Ethnic Origin
All Other
Chinese
Vietnamese
Aboriginal
Portuguese
Polish
Italian
Spanish
52.51
16.5
10.46
8.51
8.46
4.94
2.79
1.07
0
10
20
30
40
50
60
Percentage Single Origin

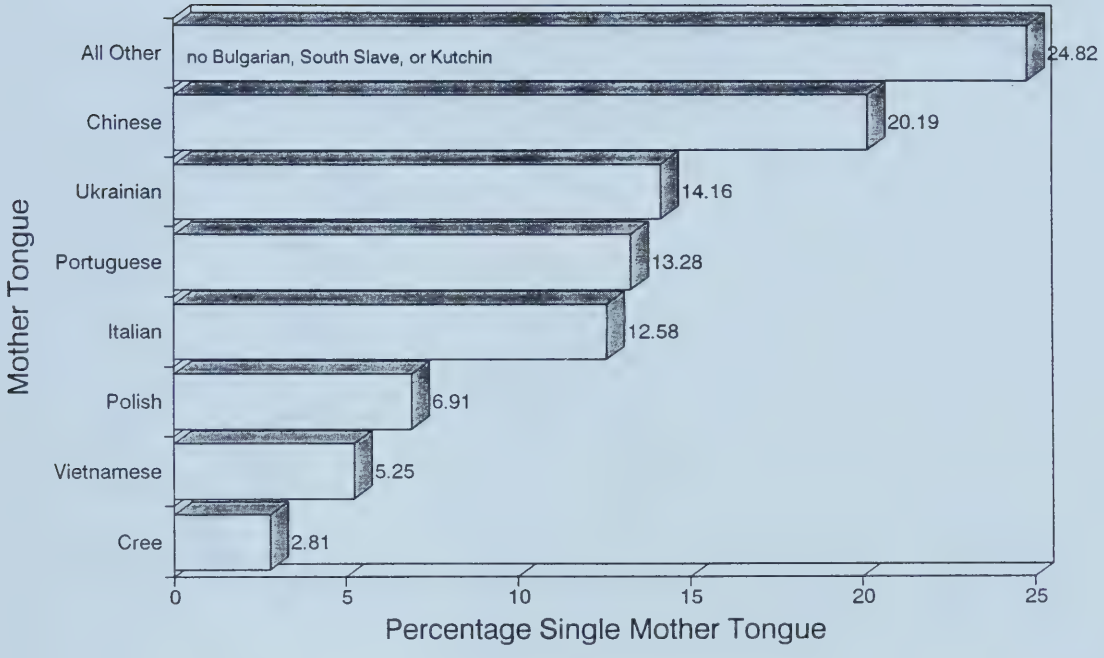
Cluster 1 Single Leading Mother Tongues Other Than English



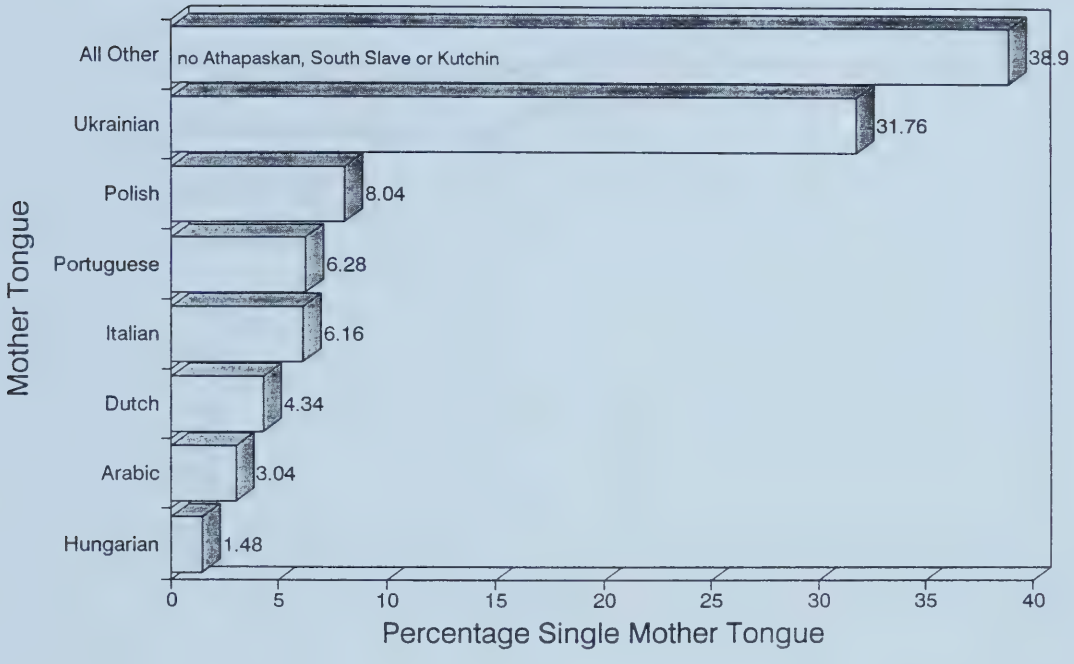
Cluster 2 Single Leading Mother Tongues Other Than English



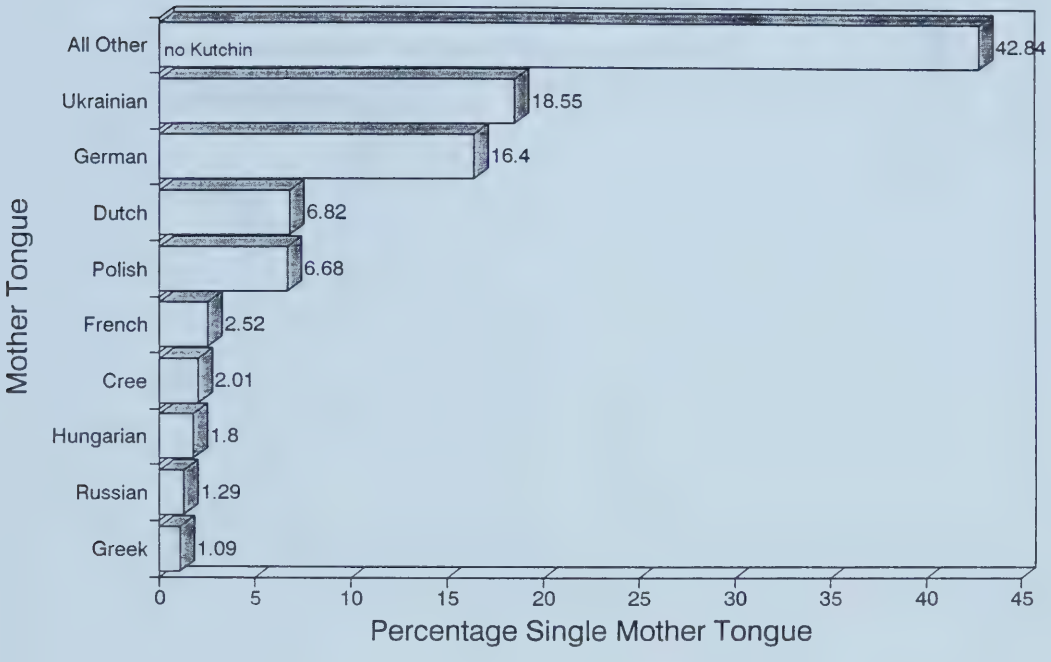
Cluster 3 Single Leading Mother Tongues Other Than English



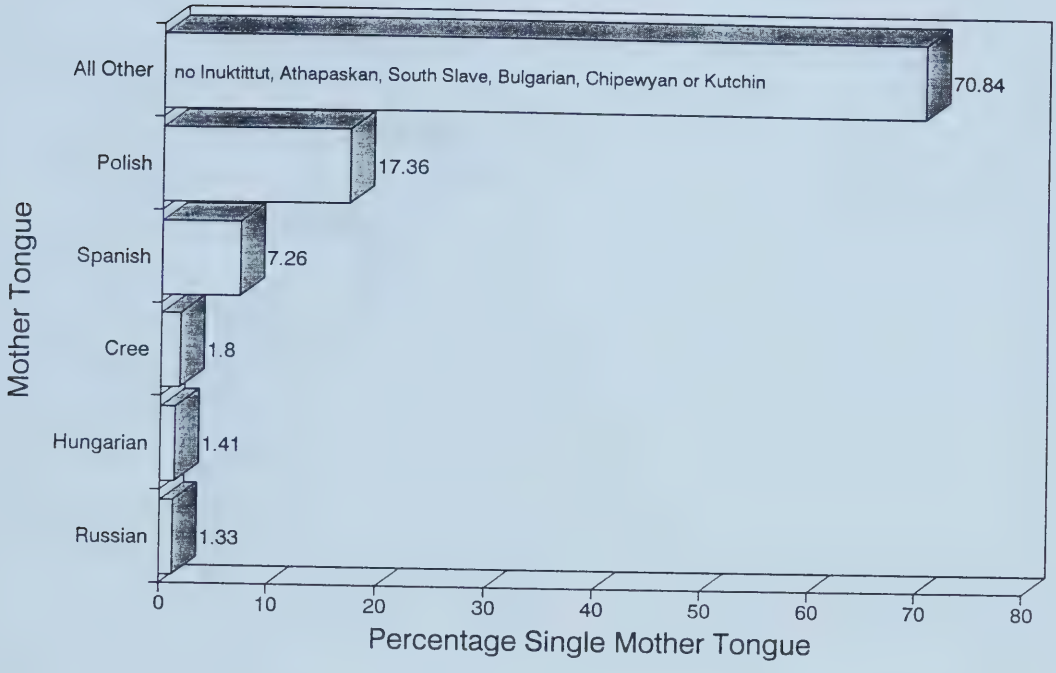
Cluster 4 Single Leading Mother Tongues Other Than English

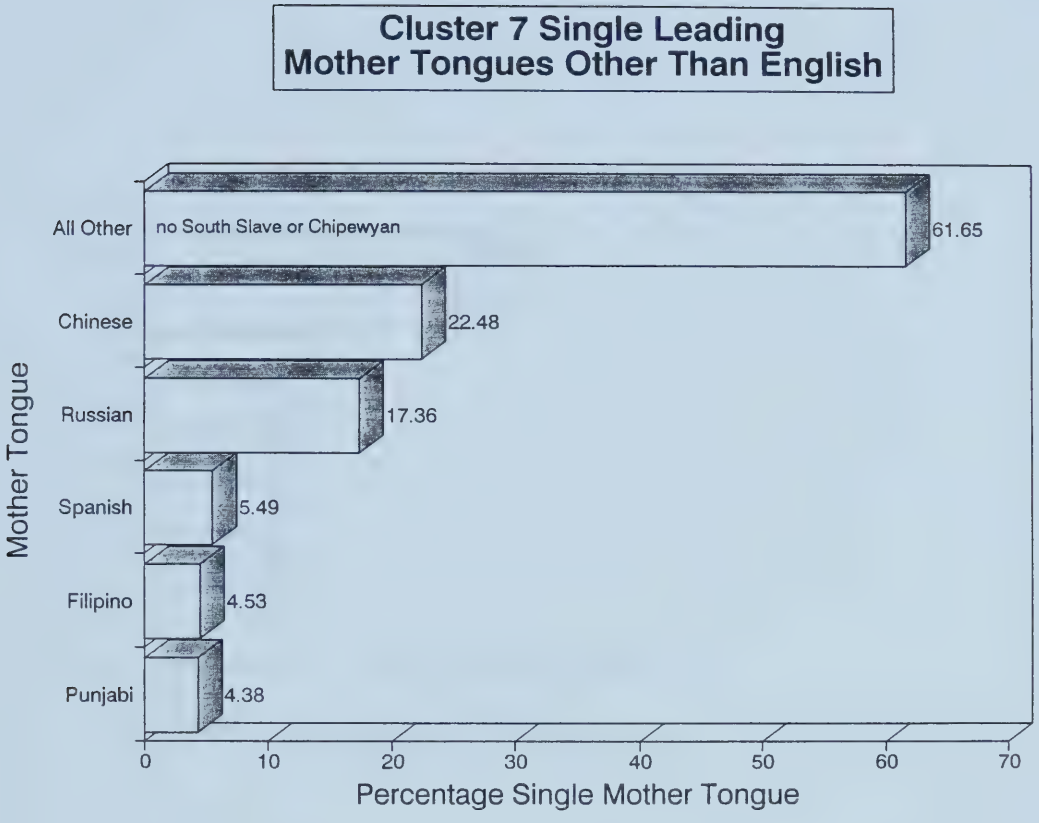


Cluster 5 Single Leading Mother Tongues Other Than English

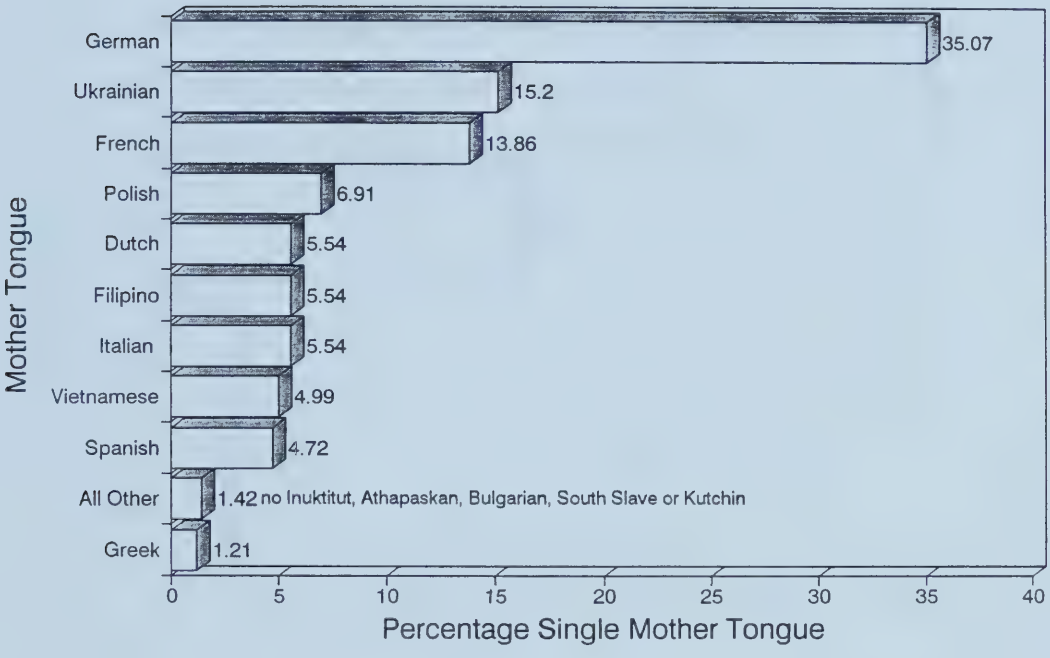


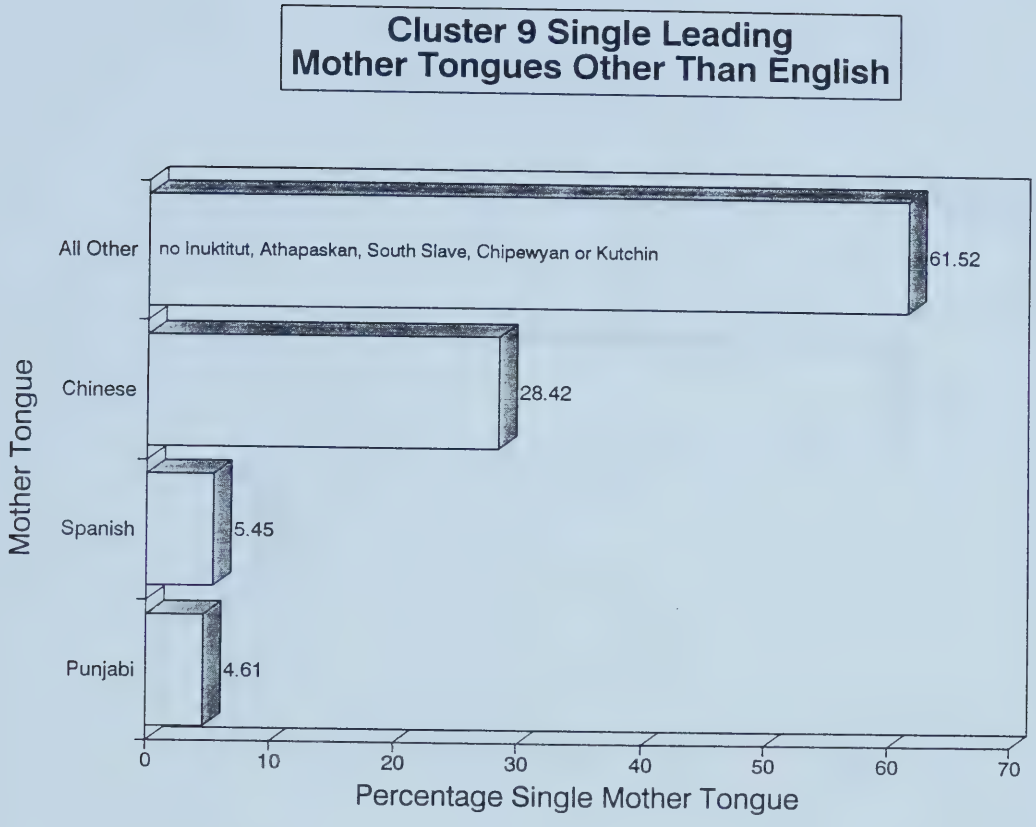
Cluster 6 Single Leading Mother Tongues Other Than English

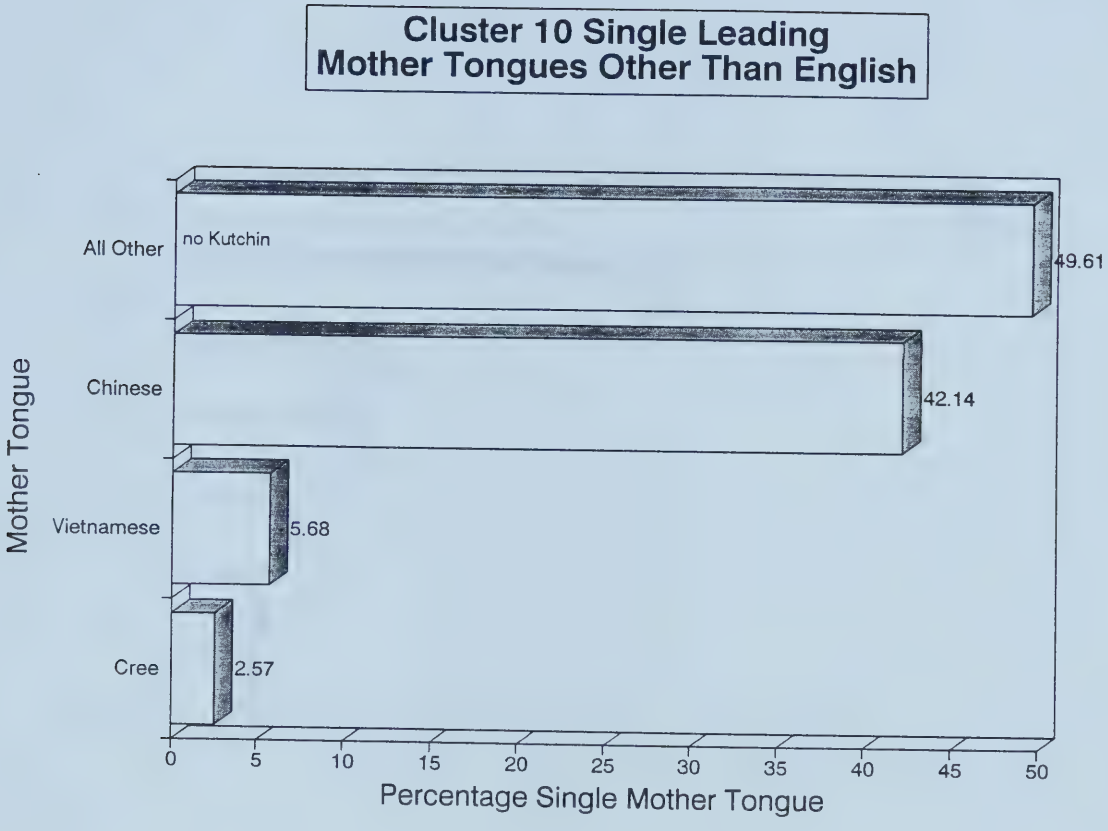


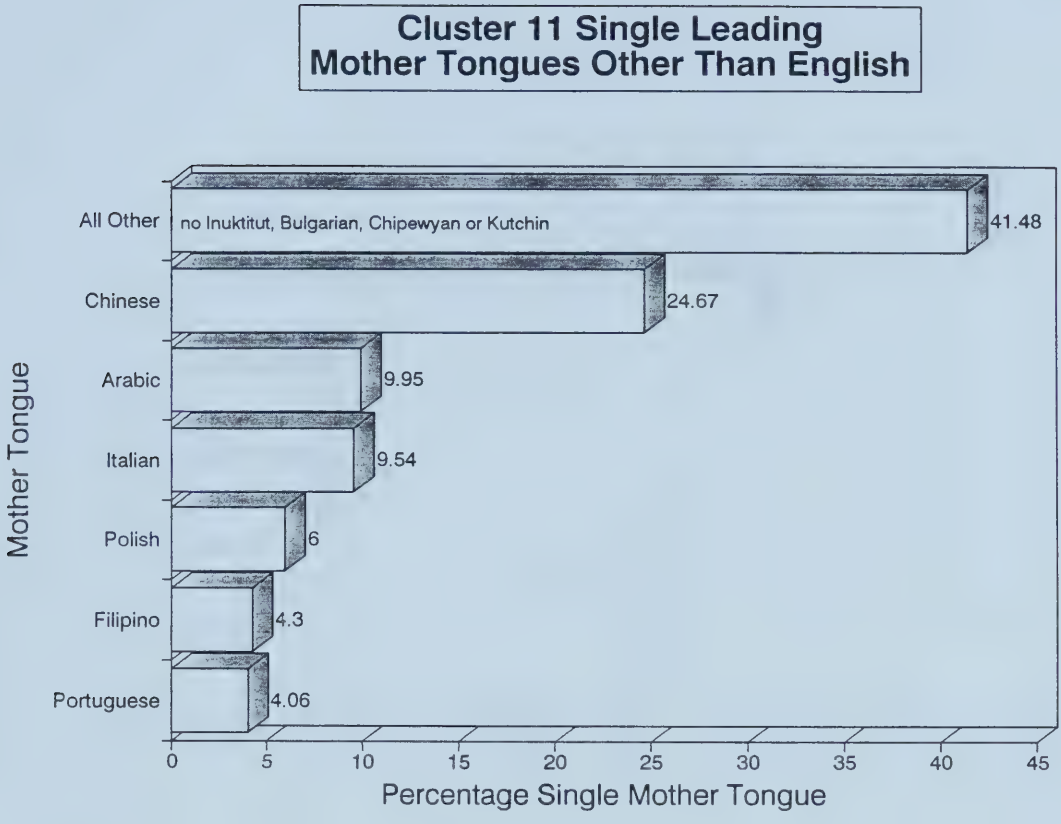

Cluster 7 Single Leading
Mother Tongues Other Than English
Mother Tongue
All Other
no South Slave or Chipewyan
61.65
Chinese
22.48
Russian
17.36
Spanish
5.49
Filipino
4.53
Punjabi
4.38
0
10
20
30
40
50
60
70
Percentage Single Mother Tongue

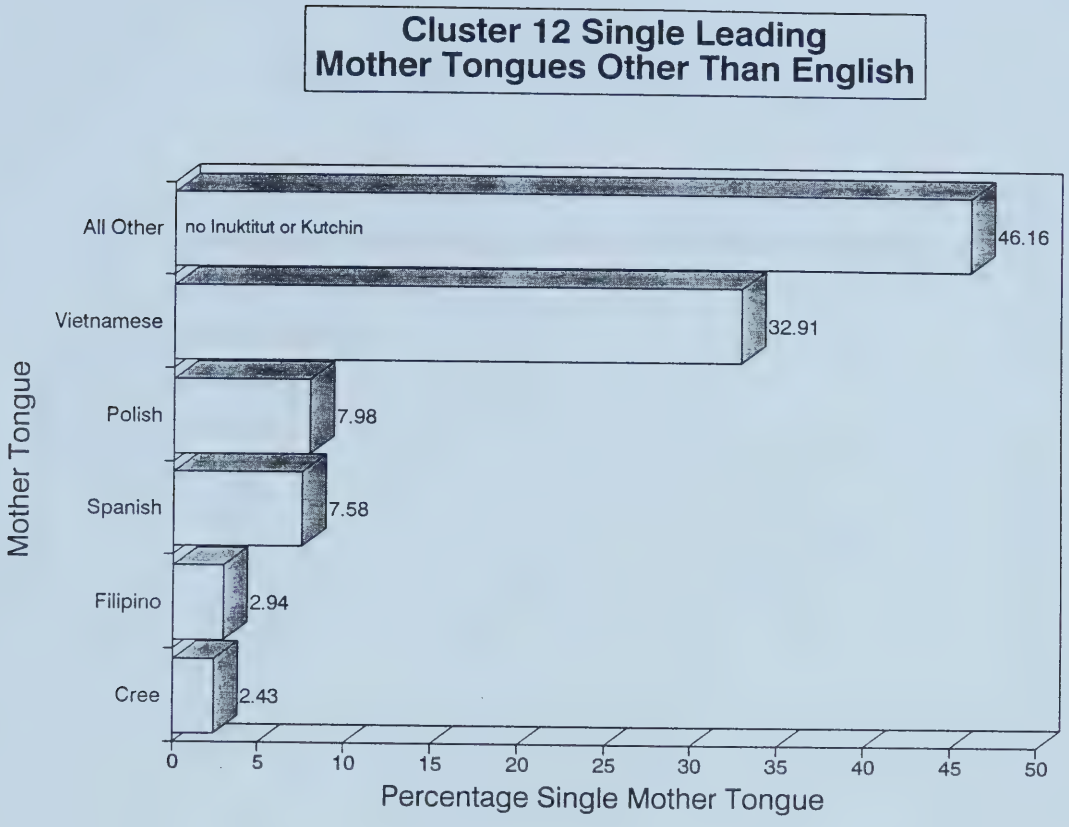
Cluster 8 Single Leading Mother Tongues Other Than English

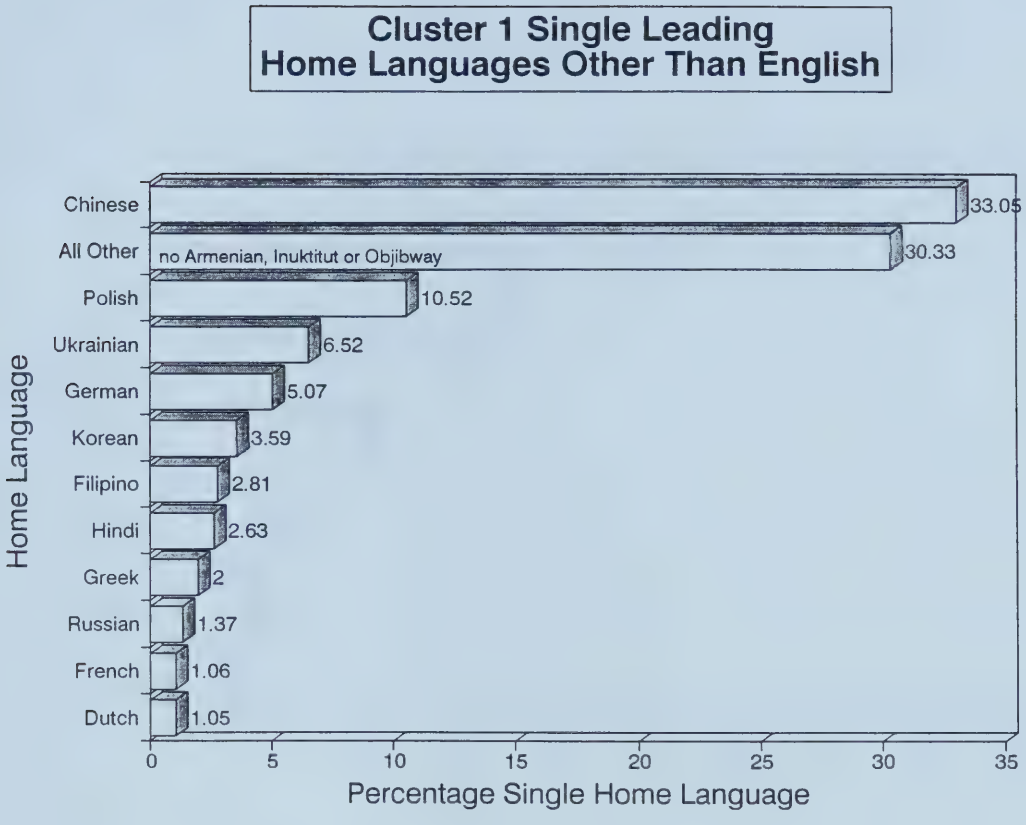


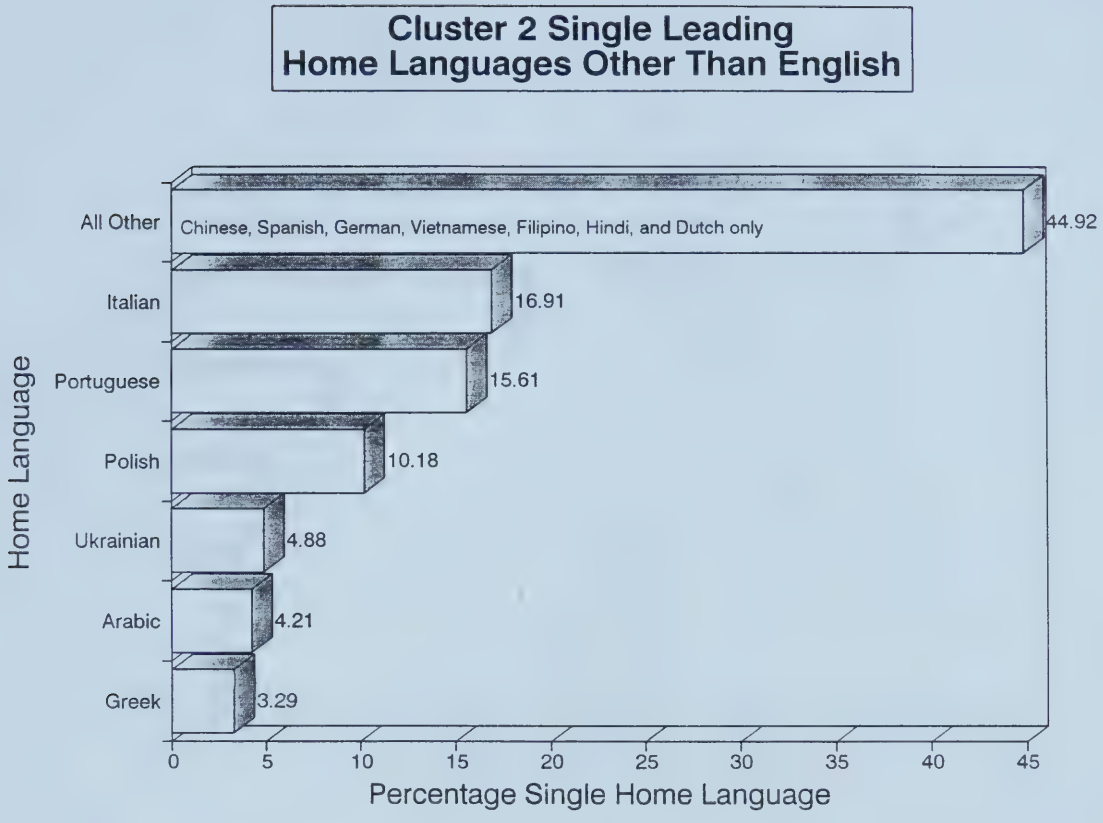

Cluster 9 Single Leading
Mother Tongues Other Than English
All Other
no Inuktitut, Athapaskan, South Slave, Chipewyan or Kutchin
61.52
Chinese
28.42
Spanish
5.45
Punjabi
4.61
Mother Tongue
0
10
20
30
40
50
60
70
Percentage Single Mother Tongue


Cluster 10 Single Leading
Mother Tongues Other Than English
Mother Tongue
All Other
no Kutchin
49.61
Chinese
42.14
Vietnamese
5.68
Cree
2.57
0
5
10
15
20
25
30
35
40
45
50
Percentage Single Mother Tongue

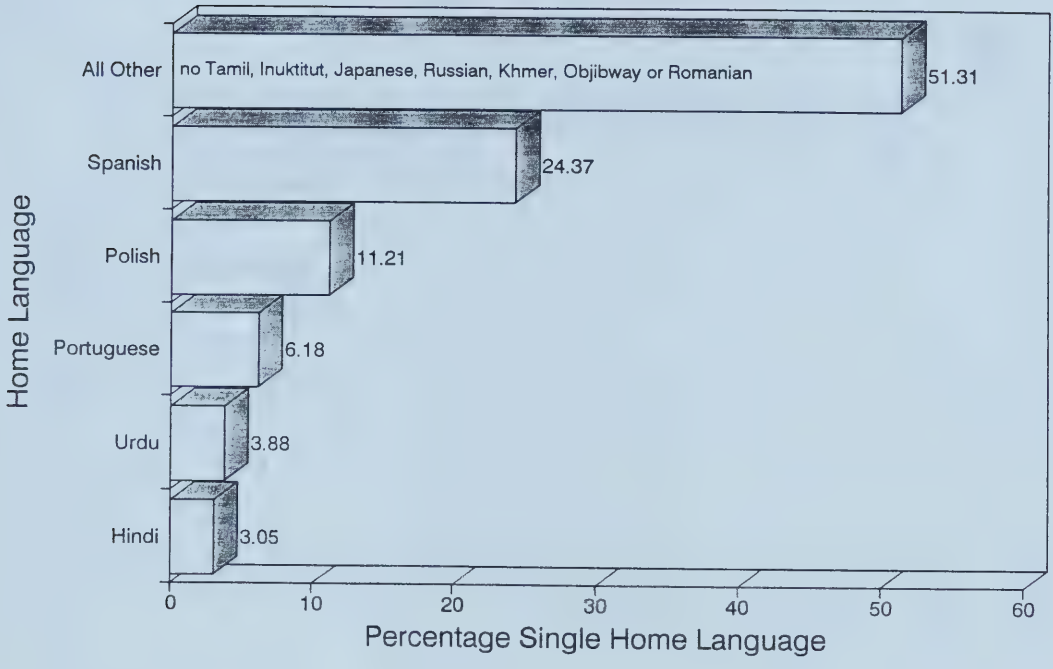

Cluster 11 Single Leading Mother Tongues Other Than English
Mother Tongue
All Other
no Inuktitut, Bulgarian, Chipewyan or Kutchin
41.48
Chinese
24.67
Arabic
9.95
Italian
9.54
Polish
6
Filipino
4.3
Portuguese
4.06
0
5
10
15
20
25
30
35
40
45
Percentage Single Mother Tongue


Cluster 12 Single Leading
Mother Tongues Other Than English
Mother Tongue
All Other
no Inuktitut or Kutchin
46.16
Vietnamese
32.91
Polish
7.98
Spanish
7.58
Filipino
2.94
Cree
2.43
0
5
10
15
20
25
30
35
40
45
50
Percentage Single Mother Tongue

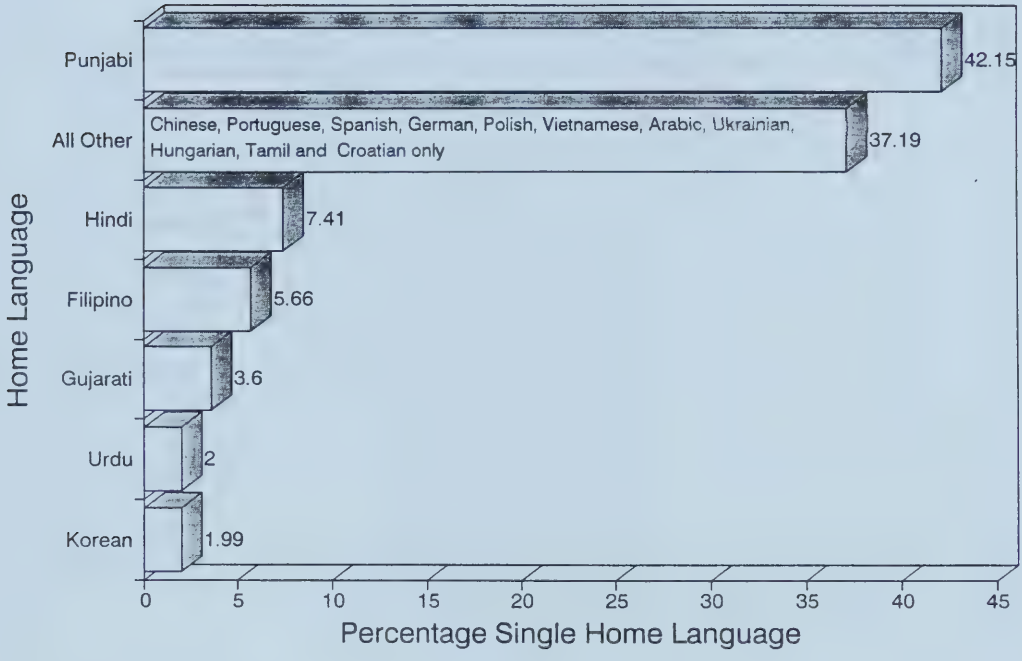

Cluster 1 Single Leading
Home Languages Other Than English
Home Language
Chinese
All Other
no Armenian, Inuktitut or Objibway
Polish
Ukrainian
German
Korean
Filipino
Hindi
Greek
Russian
French
Dutch
33.05
30.33
10.52
6.52
5.07
3.59
2.81
2.63
2
1.37
1.06
1.05
0
5
10
15
20
25
30
35
Percentage Single Home Language


Cluster 2 Single Leading
Home Languages Other Than English
Home Language
All Other
Chinese, Spanish, German, Vietnamese, Filipino, Hindi, and Dutch only
44.92
Italian
16.91
Portuguese
15.61
Polish
10.18
Ukrainian
4.88
Arabic
4.21
Greek
3.29
0
5
10
15
20
25
30
35
40
45
Percentage Single Home Language

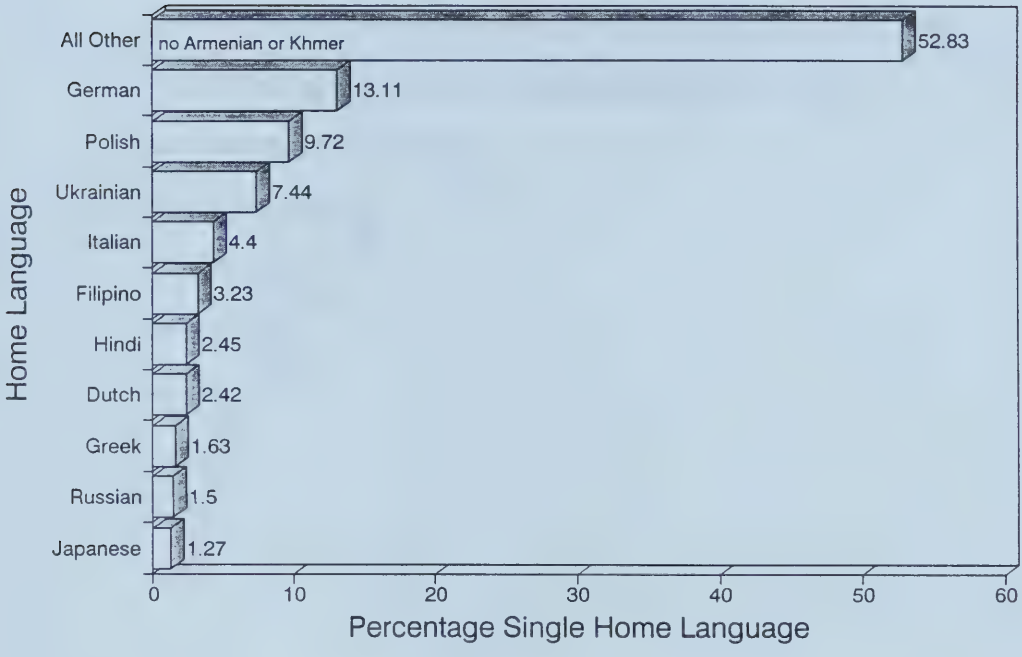
Cluster 3 Single Leading Home Languages Other Than English



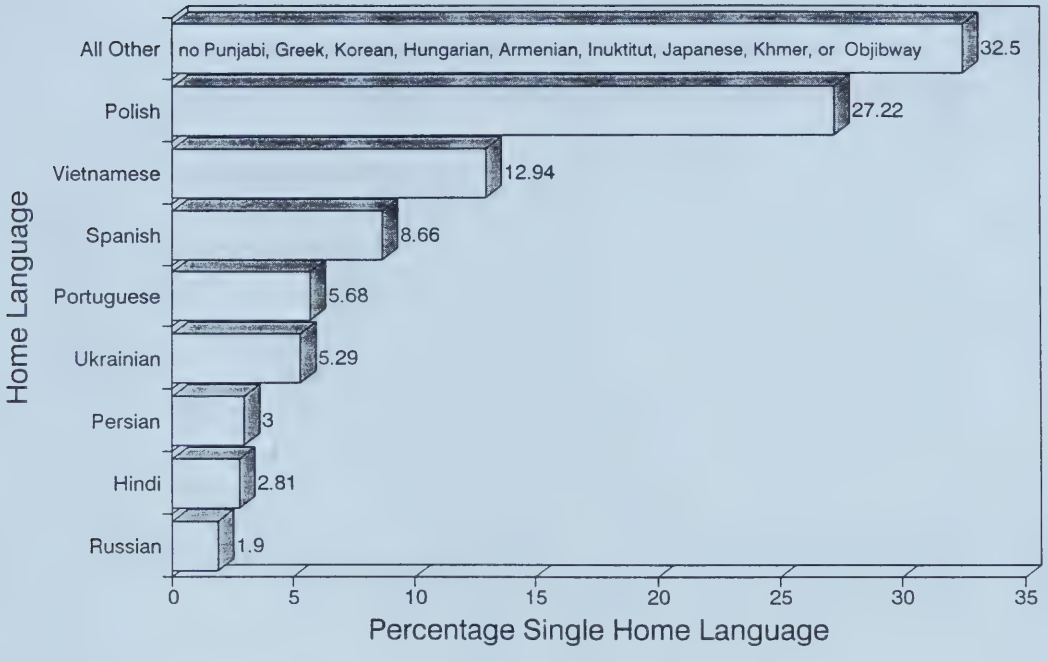
Cluster 4 Single Leading Home Languages Other Than English



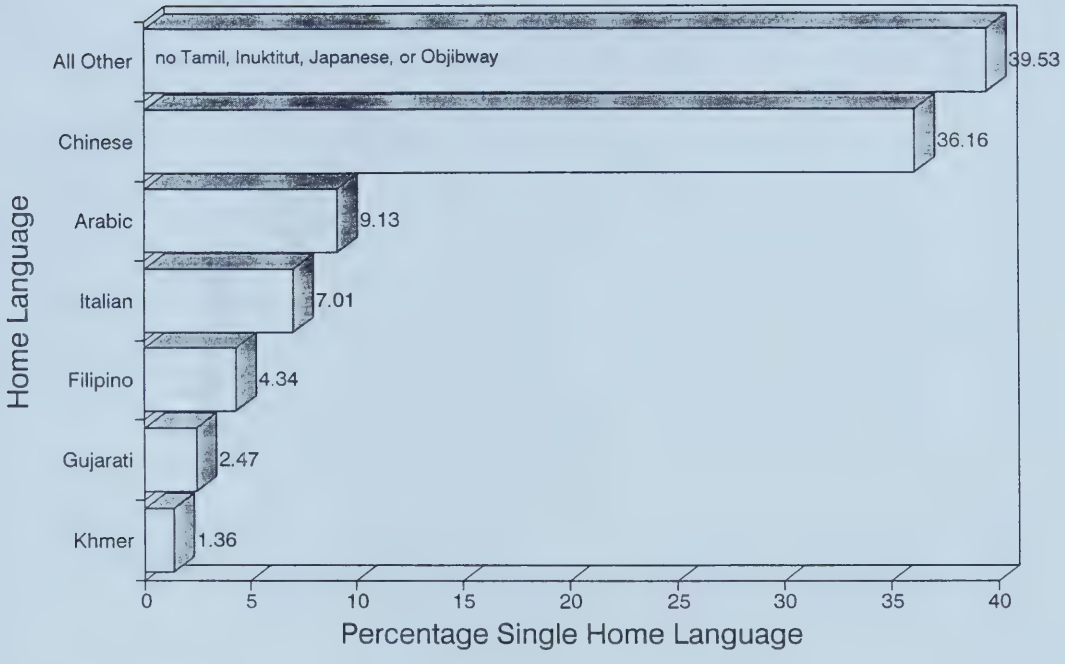
Cluster 5 Single Leading Home Languages Other Than English



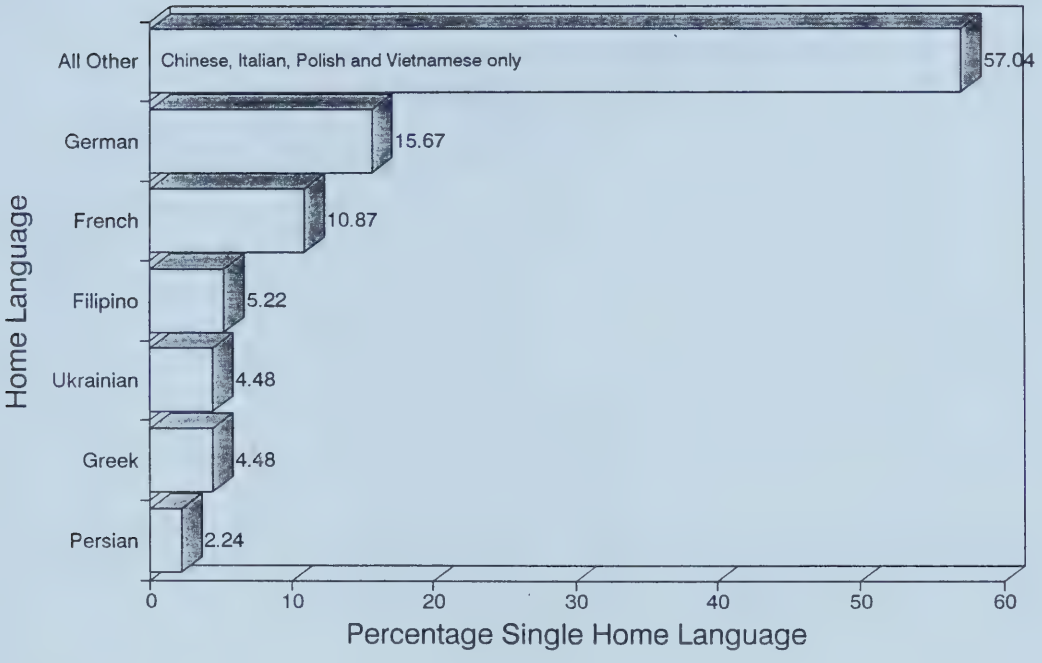
Cluster 6 Single Leading Home Languages Other Than English



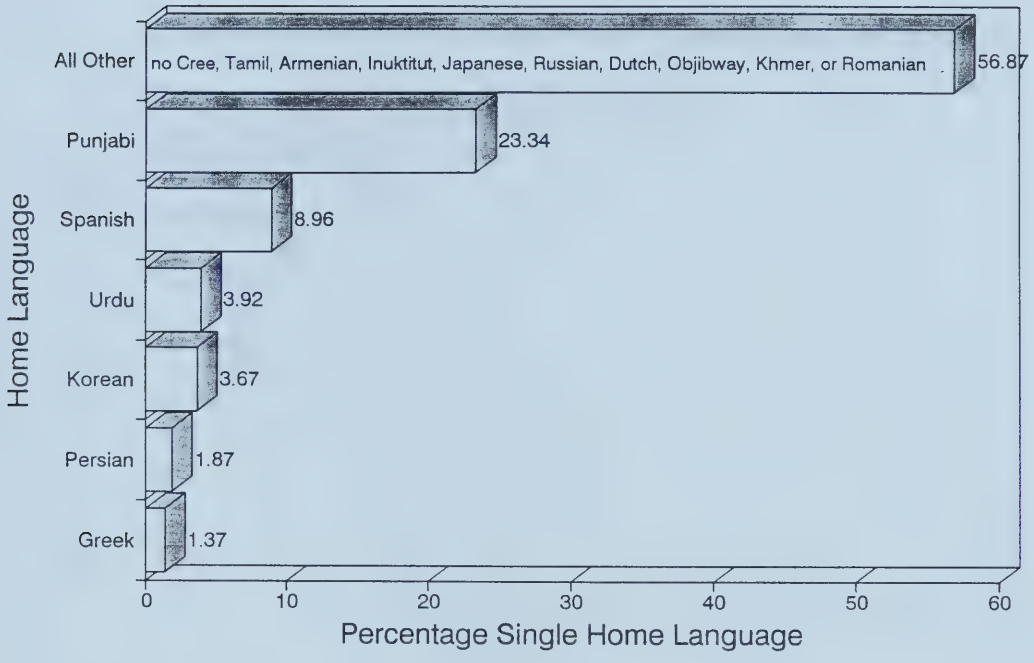
Cluster 7 Single Leading Home Languages Other Than English



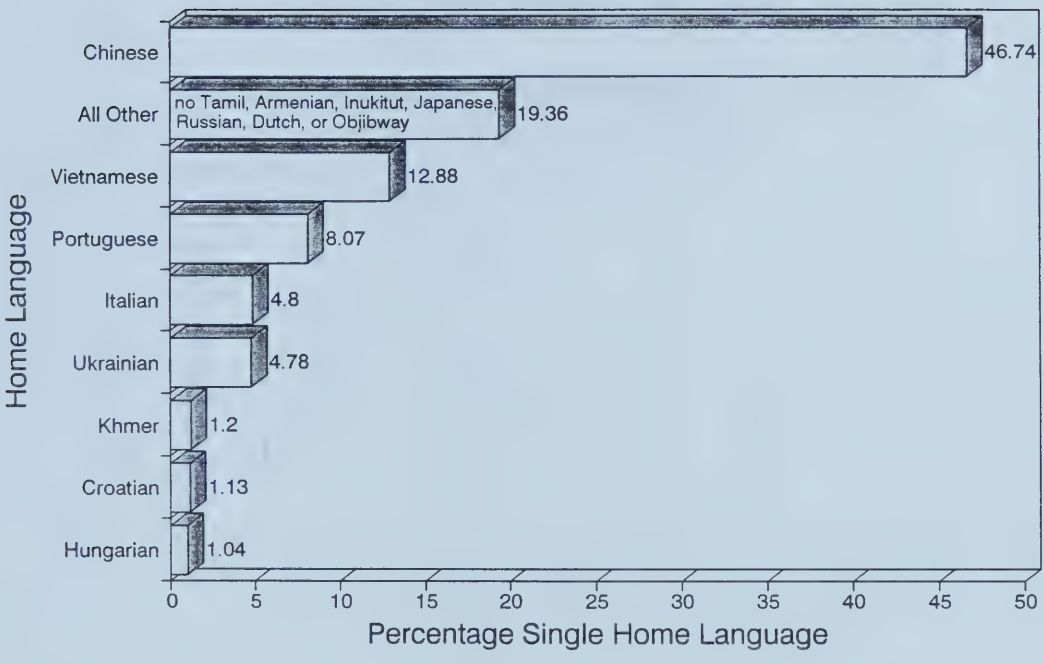
Cluster 8 Single Leading Home Languages Other Than English



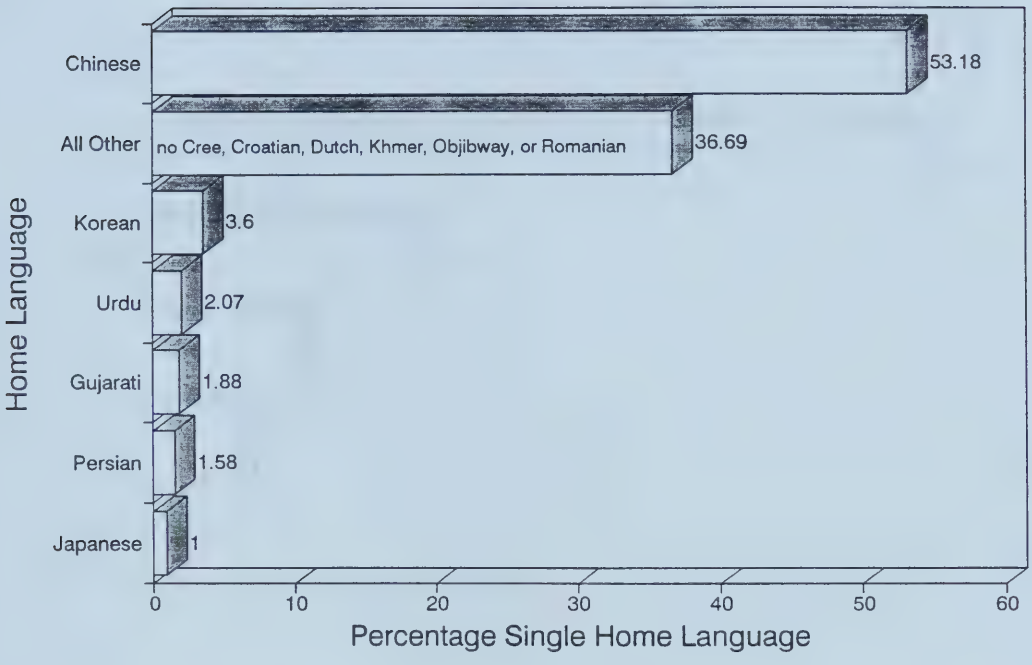
Cluster 9 Single Leading Home Languages Other Than English

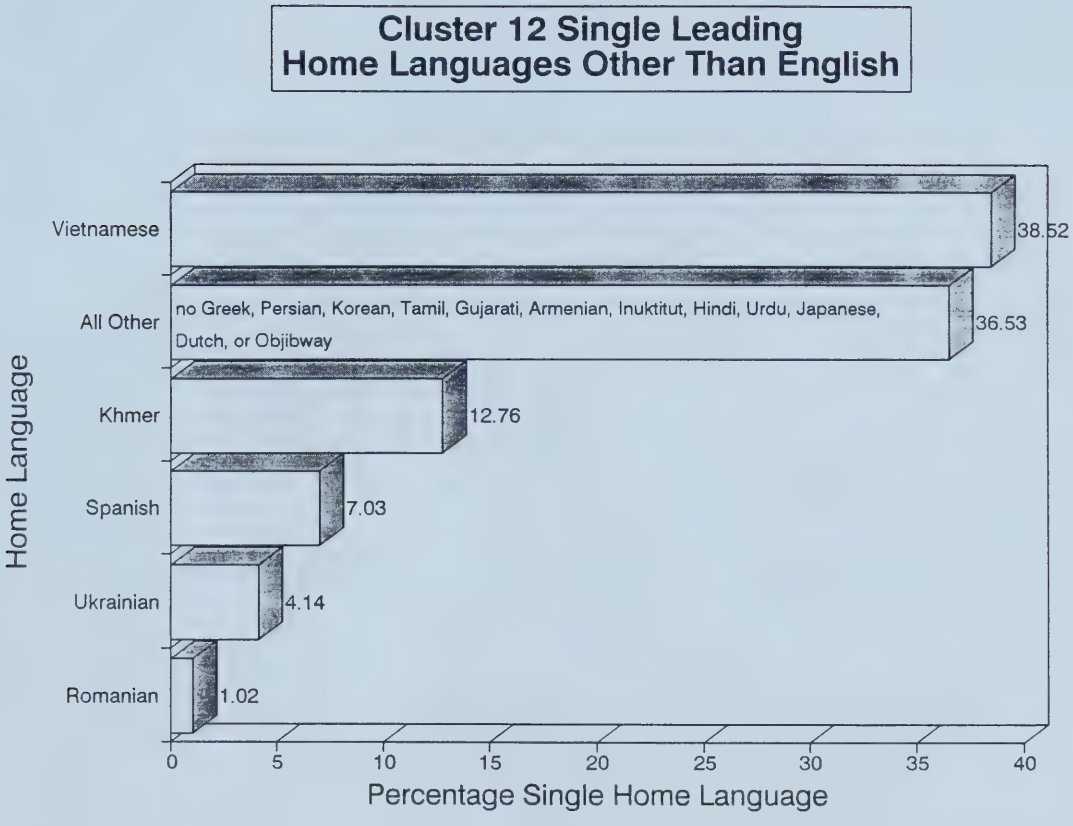


Cluster 10 Single Leading Home Languages Other Than English



Cluster 11 Single Leading Home Languages Other Than English




Cluster 12 Single Leading
Home Languages Other Than English
Vietnamese
All Other
no Greek, Persian, Korean, Tamil, Gujarati, Armenian, Inuktitut, Hindi, Urdu, Japanese,
Dutch, or Objibway
Khmer
Spanish
Ukrainian
Romanian
38.52
36.53
12.76
7.03
4.14
1.02
Home Language
0
5
10
15
20
25
30
35
40
Percentage Single Home Language

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